AgriLink

AgriLink. Agricultural Knowledge: Linking farmers, advisors and researchers to boost innovation

Deliverable 2.2: Synthesis Country Report (Version 1.0)
Partner: Agricultural University of Athens

The role of advisory services in farmers' decision making for innovation uptake. Insights from case studies in *Greece*

Part 2.

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Greece
September 2019

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List of acronyms

AgriLink	Agricultural Knowledge: Linking farmers, advisors and researchers to boost innovation
AOS	Advisory Organisation Supplier
AKIS	Agricultural Knowledge and Innovation System
DoA	Description of the Action
EU	European Union
Micro-AKIS	Micro-level Agricultural Knowledge and Innnovation System
NGO	Non-Governmental Organisations
NUTS	Nomenclature of Territorial Units for Statistics
R-FAS	Regional Farming Advisory System
TCM	Trigger-Cycle Model
WP	Work package
OPEGEP- AGROCERT	Organization for the Certification and Supervision of Agricultural Products
MD	Method of mating disruption (sexual confusion) of insects
NRDP	National Rural Development Program
TEI	Technological Educational Institute
ASYST	Agricultural Stevia Cooperative
DDFT	Department of Deciduous Fruit Trees of Naoussa
ELGO DIMITRA	Hellenic Agricultural Organization
Adv. Co.	Advisory company
IACS	Integrated Administration and Control System
MAICH	Mediterranean Agronomic Institutes of Chania
A-Coop	Leading cooperative

the farming sector with 43% (18 farmers) practicing farming simultaneously with other professional activities. The range of professions varies: freelancers, public and/or private sector employees (including agronomists, car mechanics, engineers and electricians).

Figure 9: Farming experience (MD)

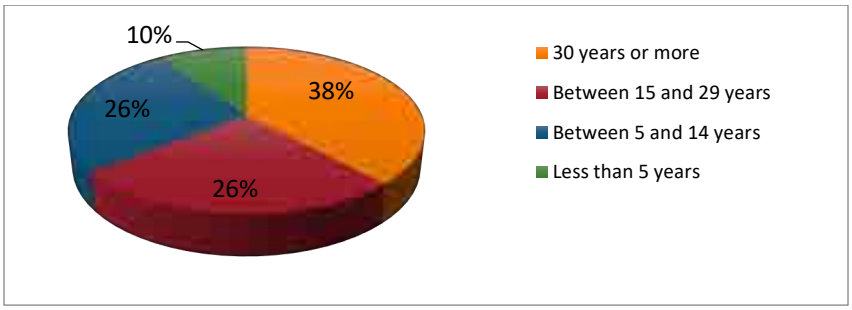
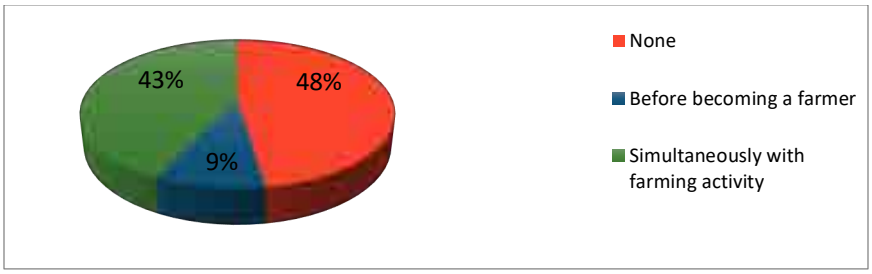
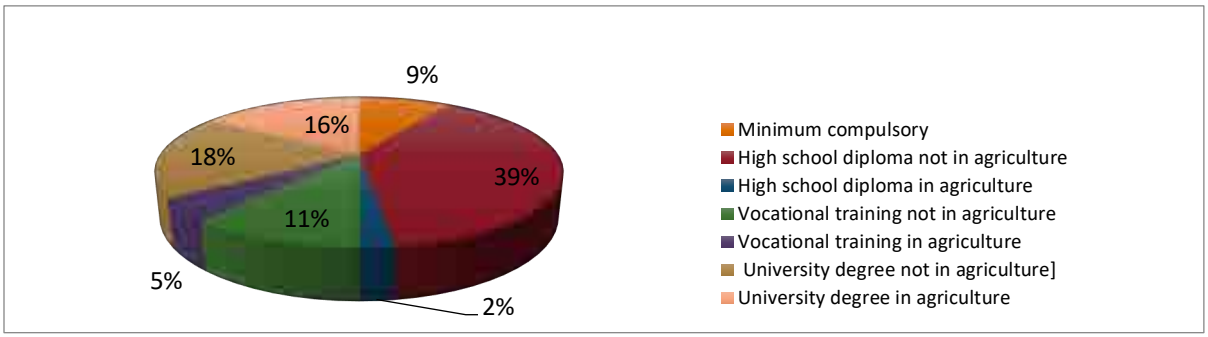


Figure 10: Non farming professional experience (MD)



As far as the interviewees' educational level is concerned, only 5% had vocational training, while 16% held a university degree in agriculture (Figure 11). Additionally, 62% (26 farmers) had participated in training courses on several topics (new crop management techniques, mating disruption, new technologies) during the previous year. With reference to the existence of successor, this was the case of only one out of the six farmers (14.3%) aged above 60 years old who participated in this survey.

Figure 11: Educational level (MD)



All farm holdings, but one, were identified as family holdings (97.6%). The farmers cultivated, on average, 8 ha of which 78% own land; fruit trees cover 95% of the cultivated land. Almost half of the farmers made use of smartphones to deal with farm management issues, while a considerable number of them made use

of desk computers and laptops as well (Table 3). Over 80% of the farm holdings employed hired workers even though not always on a full time basis (Table 4).

Table 3: Use of digital devises (MD)

Activity	Digital tool	Frequency	Percentage
Bookkeeping	Laptop	3	7.1
Bookkeeping	Desk computer	2	4.8
Management	Smartphone	20	47.6
Management	Tablet	8	19.0
Management	Laptop	11	26.2
Management	Desk computer	17	40.5
Subsidies management	Desk computer	1	2.4
Crop management][Smartphone	Smartphone	6	14.3
Crop management	Tablet	1	2.4
Crop management	Laptop	4	9.5
Crop management	Desk computer	4	9.5

All the farm holdings channelled their products in the markets through traders or the cooperatives they are members of. None of the farmers was engaged in other than farming activities, while 93% received subsidies correspond to less than 25% of the total income generated by the holding for 85.7% of the sample (36 farmers).

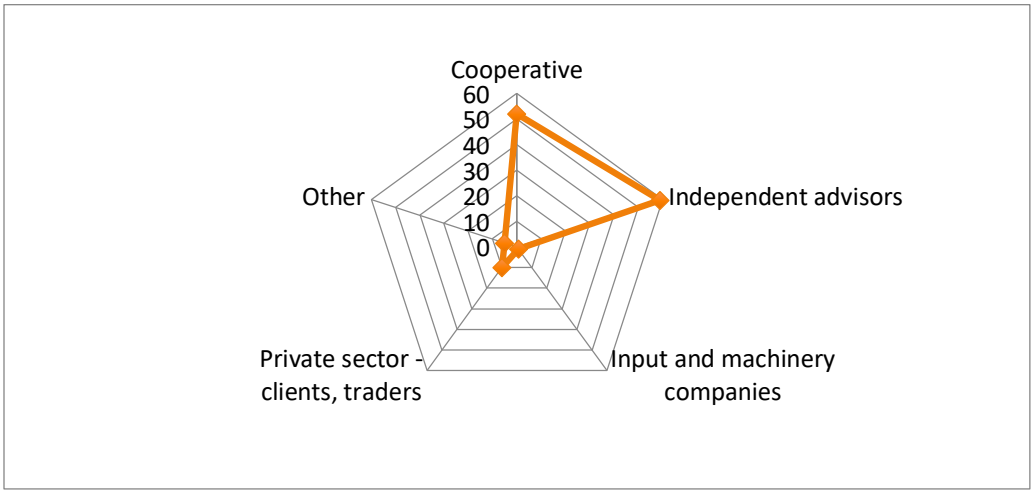
Table 4: Farm labour force

	Frequency	Percentage
Hired workers permanent	34	81.0
Hired workers temporary	10	23.8
Family workers full time	22	52.4
Family workers part time	15	35.7

5.1.1.2 Farmers' attitude towards innovation and change

The local cooperatives and the advisors working for collaborating with the coops private independent advisory companies were the key advice providers in Imathia. Retailers, traders, input machinery companies and others (corresponding to peers-farmers or agronomists), supplement the picture of farm advice providers although in a minor role (Figure 12). It is noted that the cooperatives and the collaborating advisory companies were often engaged in common advisory activities in order to support farmers to meet the IPM standards.

Figure 12: General micro-AKIS (MD)



The most widely used advisory/communication method is individual -one by one- contact, followed by seminars /workshops and contact by phone, SMS and email (Figure 13). This certainly points to the significance of interpersonal contacts in the advisory/innovation process, since discussions with others is farmers' most important source of knowledge (figure 14).

Figure 13: Advisory methods (MD)

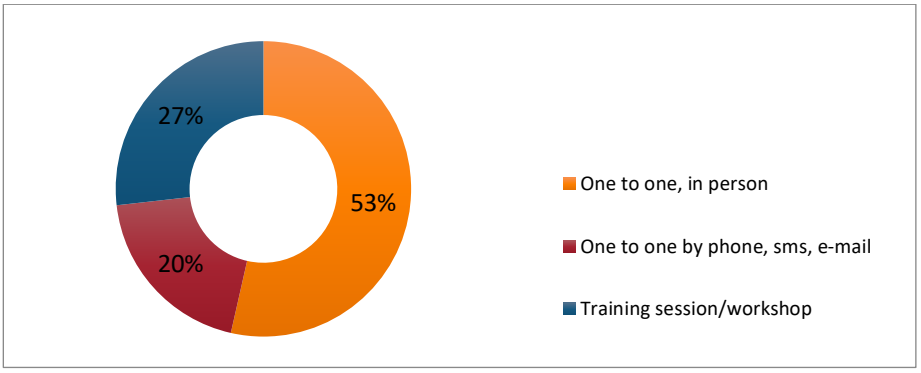
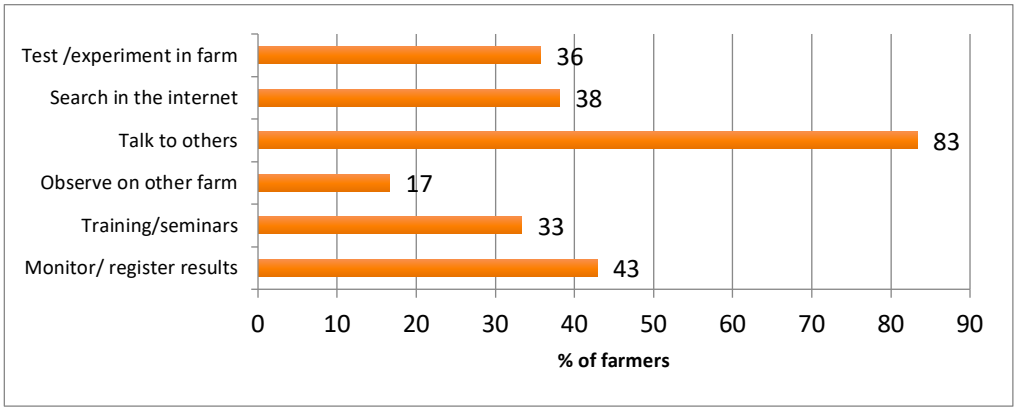


Figure 14: Important sources of knowledge (MD)



Farmers' needs concerned technical, marketing and certification issues as well as subsidies (Figure 15 to Figure 18).

Figure 15: Technical advice (MD)

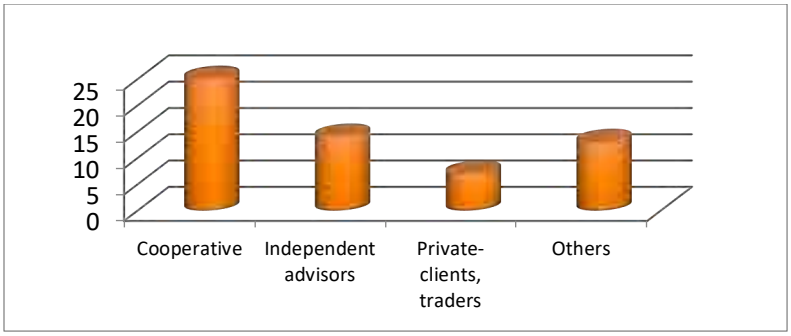


Figure 16: Marketing (MD)

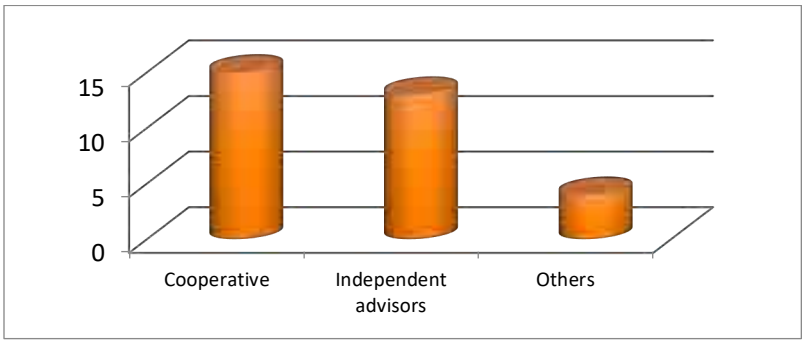


Figure 17: Certification (MD)

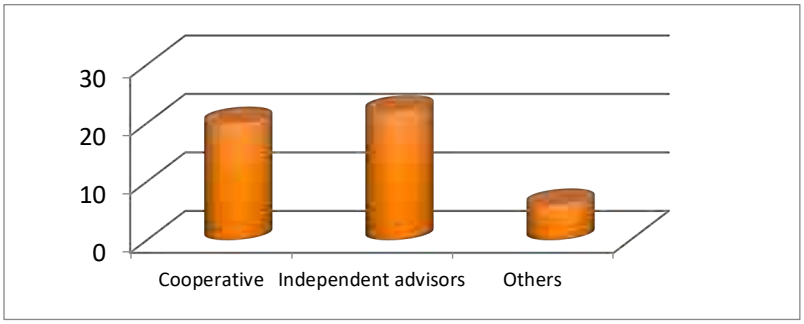
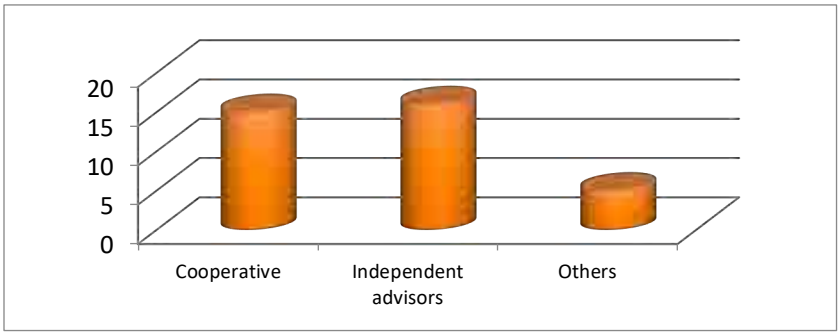


Figure 18: Subsidies (MD)



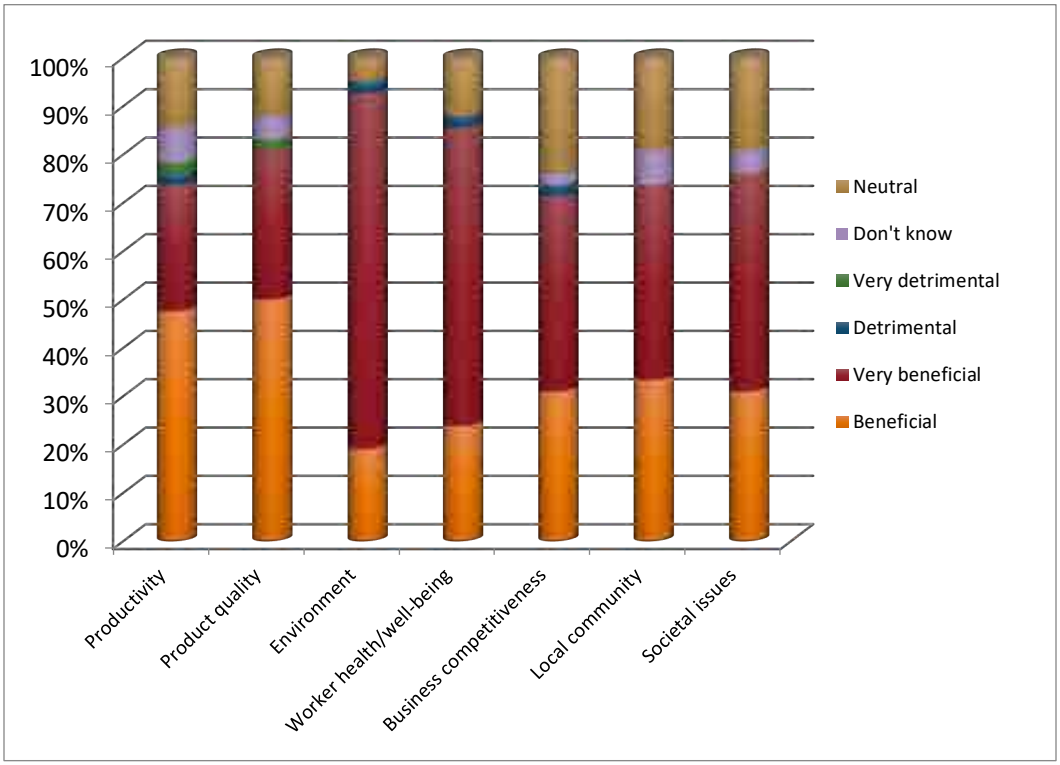
5.1.1.3 Farmers' innovation paths and trigger cycle change model

The sample of farmers consists of 25 adopters and 17 non-adopters. The adoption rate of the method varied considerably all over the region of Imathia, while both adopters and non- adopters identified several reasons guiding them to contrary decisions.

The reasons for non-adoption (as identified mainly by adopters) are indifference to the problems caused by the use of pesticides; forthcoming retirement of the farmer; financial difficulties, since adopters had to cover the labour cost for hanging the micro-sprayers (not covered by the agri-environmental measure subsidy); and worries about the bureaucratic procedures leading to delays in the reimbursement of expenses/costs. Some farmers (progressive ones) awaited reduced spraying, although many others (both adopters and non-adopters) believed that this was not evident yet, thus making some farmers, who believe that it was pointless to be the first who adopt, to wait for others to adopt first. On the other hand, a reason for adoption referred to by farmers is the pressure certain cooperatives exerted to their members in order to comply with the IPM standards.

In general, both adopters and non-adopters evaluated that MD is beneficial (figure 19). However, a small minority of non-adopters, including some agronomists, argued that MD is detrimental for both farmers' income and the environment since it disturbs the already fragile ecology of the area.

Figure 19: Evaluation of the MD



The introduction of the MD in Imathia was the response of local cooperatives to the fruit markets demands for safe and healthy products. In 1999 the Board of a leading cooperative experienced a failure in the USA market, which resulted in launching collaboration with an independent advisory company specialised in the implementation of quality systems. In 2001, during his visit to a research Institute in Italy, the advisor in charge of this advisory company became aware of the MD; simultaneously he was informed that a relevant experiment was carried out by the Department of Deciduous Fruit Trees of Naoussa (DDFT). The collaboration between the advisory company and the cooperative and their continuous interest to reduce/give up the use of pesticides led them to the initiation of pilot fields in 2004-2006 in the framework of a research program. The implementation of the MD started again in 2009, since it was promoted and partially subsidized (by the coops) by a growing number of cooperatives while in 2014 it was included in the agri-environmental measures of the NRDP and thus its implementation was subsidized by the NRDP. This development is also depicted in the farmers' awareness timeline (figure 20).

Figure 20: Initiation of awareness (MD)

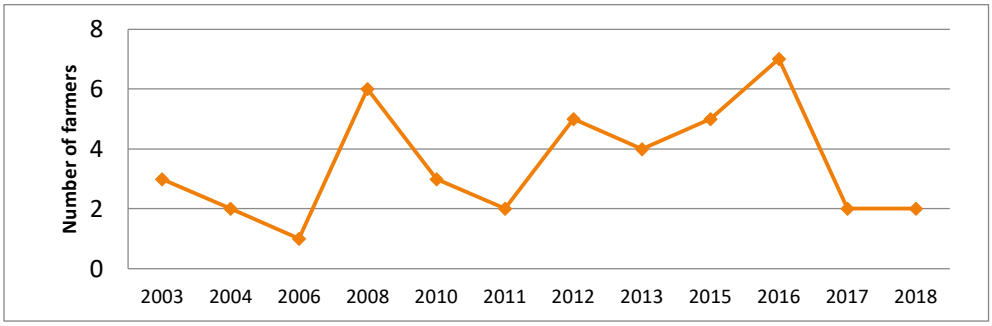
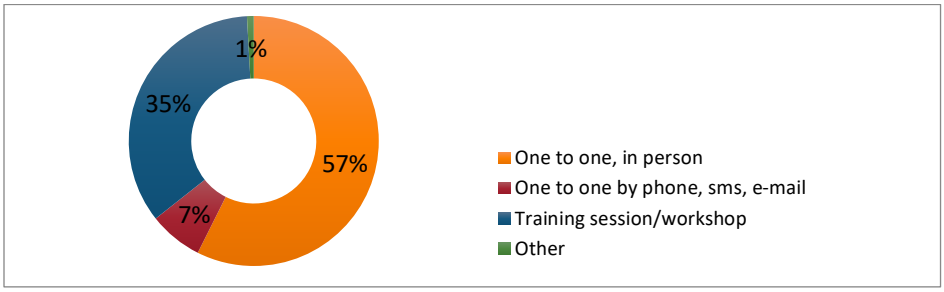
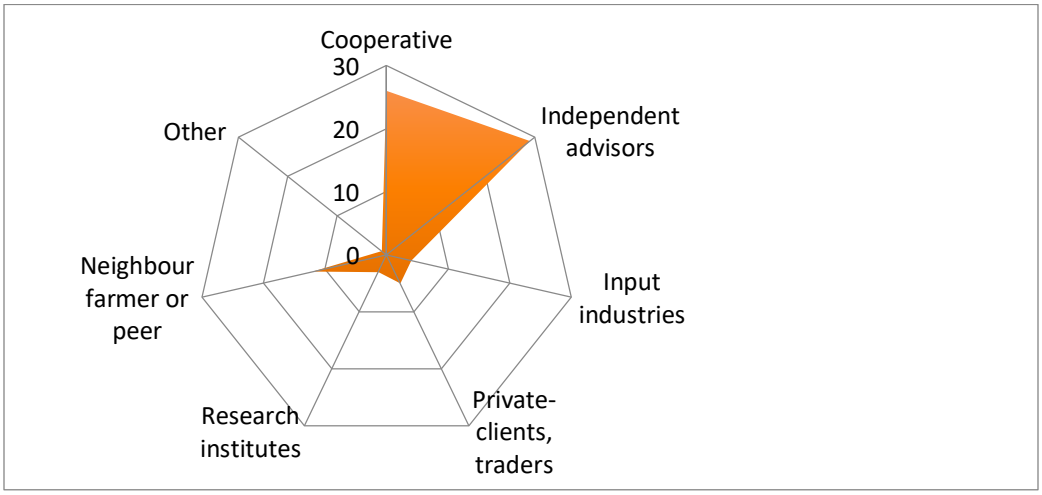


Figure 21: Communication methods – Awareness (MD)



The first few adopters of the method were members of the coop Board or good friends of them, who shared common interests and were connected with long time, trust relationships. Gradually more farmers were becoming aware of the method as a result of information activities based mainly on personal interactions with advisors and events jointly organized by the cooperatives and the advisory company as well as through personal contacts with peers (Figure 21 and Figure 22).

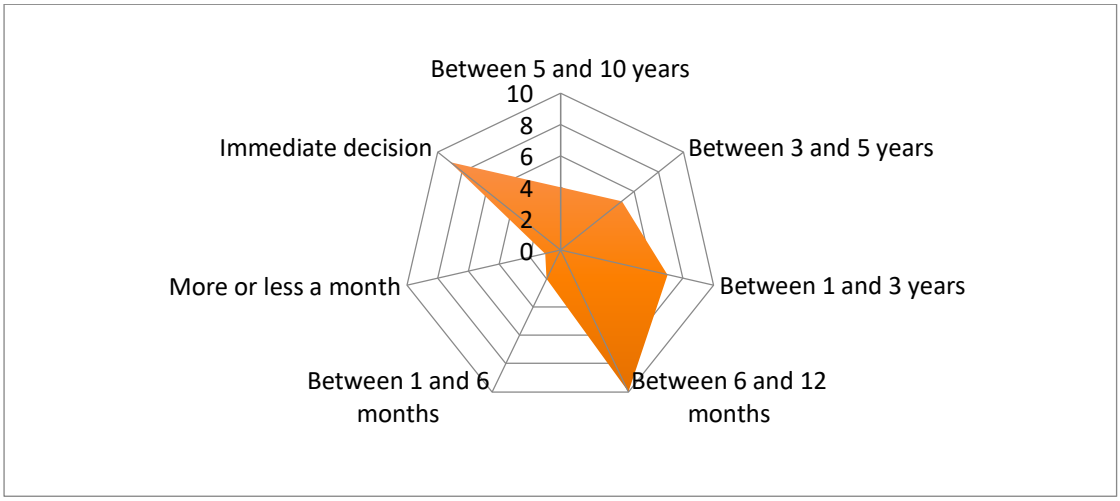
Figure 22: Actors – Awareness (MD)



These awareness-raising activities resulted in more than 20% of the interviewed farmers becoming engaged in a process of assessing the innovation immediately - thus their interest was triggered (Figure 23). An

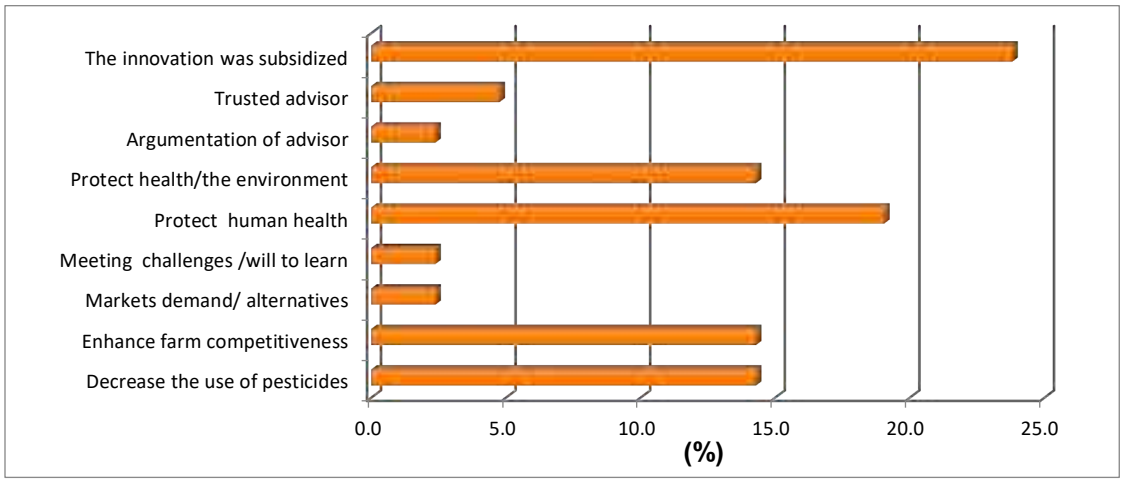
almost equal number of farmers got involved in assessment activities 6 to 12 months after the awareness event. Given that many information activities take place during the autumn and winter months before the beginning of the cultivation season, the awareness events can be considered as triggers for the initiation of the assessment period although other events may have taken place as well.

Figure 23: Time-lag between awareness and active assessment



After becoming aware of the innovation, the farmers were motivated to think seriously about the innovation by the available each time subsidy, followed by the need to protect their income, health and the environment (Figure 24). The role of the advisors in motivating farmers was essential since they disseminated valuable information, helping farmers' first assessment and decision-making through the above-mentioned seminars and personal contacts.

Figure 24: Farmers' motivation for assessment (MD)

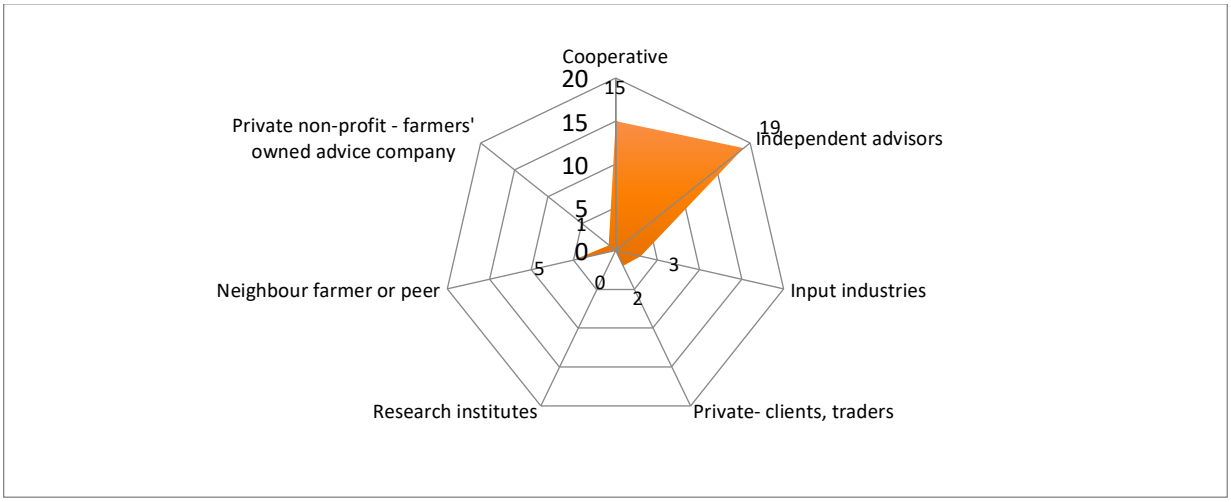


The improvement of farm competitiveness and the protection of health and the environment were the potential benefits that 43% of the interviewees took into account during assessment. However, 19% of the farmers argued that the potential benefits could only derive from proper implementation of the innovation

and inspection. The implementation cost was another important issue of concern since only 21% of the interviewees assessed that the implementation cost was affordable or bearable, despite the fact that the innovation was subsidized (albeit to different rates). The potential loss of income was a risk that 14% of the respondents took into account before making their final decision, while the potential decision of their colleagues was a source of uncertainty and a matter of concern to half of them (since the number of adopters affects the effectiveness of the method).

Twenty-five of the interviewed farmers finally decided to implement the innovation. Among all interviewees, those who were motivated mainly by their need to protect human health and the environment correspond to 18% (16 farmers). The adopters' second motivation was to secure better access to markets (19%, 8 farmers), followed by the need to decrease farm production cost (12%, 5 farmers).

Figure 25: Actors, implementation (MD)



The actors who helped the farmers during the assessment process continued supporting them during the implementation (Figure 25) on the basis of one to one (in person) communication activities (Figure 26).

Figure 26: Communication methods, implementation (MD)

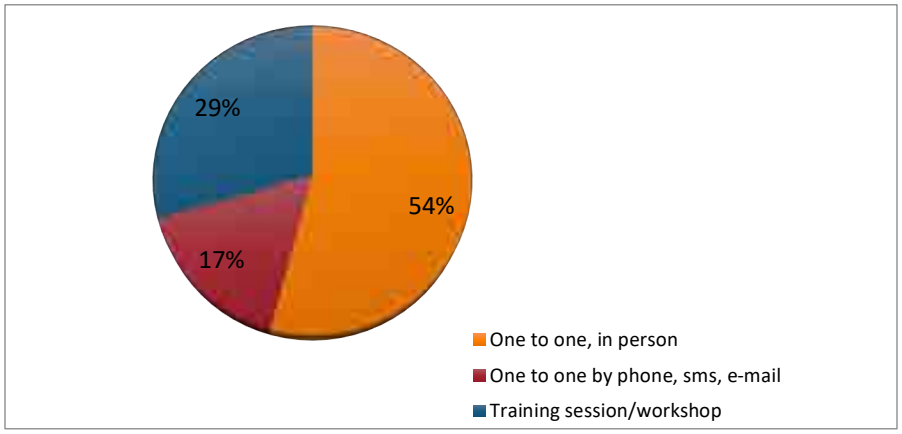
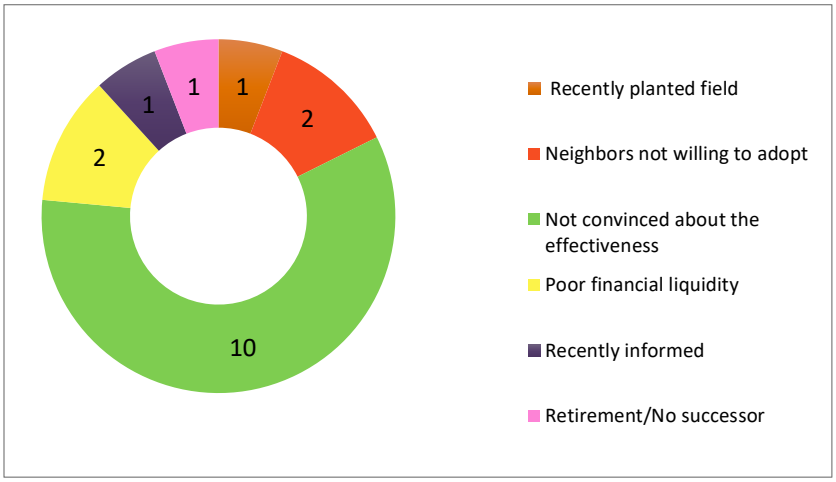
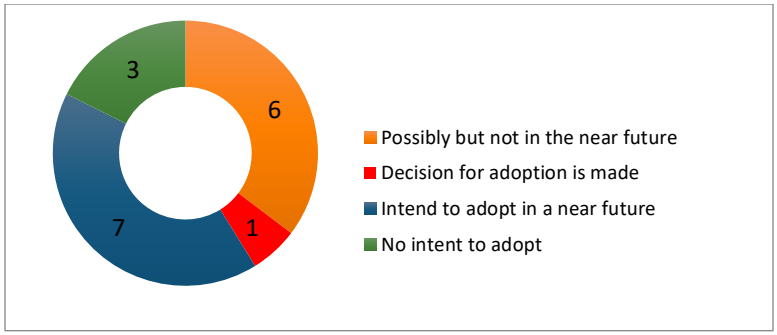


Figure 27: Reasons for non adoption (MD)



Non-adopters represent 40.5% of the sample farmers. The main reason for which they did not adopt lies in the fact that they were not convinced about the effectiveness of the method (59%) (Figure 27); however, for almost half of them adoption was in their immediate plans (Figure 28).

Figure 28: Future plans for adoption (MD)



5.1.1.4 Farmers' innovation micro-AKIS

The main actors that constitute the farmers micro-AKIS in relation to the MD were the local cooperatives/ producers' groups and the independent advisory company that introduced the innovation in the area. These actors provided continuous support to the farmers throughout the stages of the trigger change circle. Therefore, there is no differentiation among the micro–AKIS actors involved in the different stages of the trigger change circle, since several other actors played only a marginal advisory role.

Furthermore, the micro-AKIS involved in the innovation is identical with the 'general' farmers' micro-AKIS. This is expected since the interviewed farmers are almost exclusively peach growers and the 95 % of the cultivated land is covered by fruit trees.

5.1.2 Findings from the AKIS experts interviews and advisory organisations survey

5.1.2.1 Advisory landscape in the focus region

The advisory landscape of the farmers cultivating tree-orchards in Imathia is formed by a combination of private, public and farmer-based organizations, some of which are activated not only at the local or regional level but also operate at the national level (Table 5).

Table 5: The advisory landscape in Imathia

Advisory organization	Type of organization- Scale of action
The Department of Deciduous Fruit Trees of Naoussa	Public Research Institute - National
The Directorate of Rural Economy & Veterinary	Public sector- Local (Prefectural)
3 advisory and consultancy companies	Private sector- Local - Regional- National
Individual consultants	Private sector- Local
Input supply shops	Private sector – Local
Cooperatives- Producers' Groups	Farmer-based organizations – Local

Source: Fieldwork, 2018

The Department of Deciduous Fruit Trees of Naoussa (DDFT) is a public research institute under the umbrella of ELGO DIMITRA (the Hellenic Agricultural Organization). The institute deals with applied research for deciduous fruit crops in fields such as the evaluation of fruit varieties, cultivation practices, treatment of diseases, etc. It is involved in knowledge and information dissemination through public lectures, scientific publications, and the provision of information on its website.

The local Directorate of Rural Economy and Veterinary operates in the framework of the Ministry of Interior although it functions under the guidance of the Ministry of Rural Development and Food. It collaborates with local municipalities, implementing national and EU policies.

5.1.2.2 Key players of advice for the innovation area in the focus region

The method of the mating disruption was introduced in Imathia because of the efforts of an advisory company (Adv. Co. A) that was collaborating with a leading local cooperative. The aim of this initiative was the strengthening of the cooperative's environmental-friendly profile thus allowing it to maintain high produce standards and therefore access to well-paying markets. Gradually more cooperatives adopted the method and, along with this advisory company, achieved the inclusion of the mating disruption in the agri-environmental measures of the NRDP. This event, along with the 'collegial pressure' exerted by Adv. Co. A, helped the two other independent advisory companies activated in the region and, also, several input supply shops to start supporting the adoption of MD. Nevertheless, Adv. Co. A still plays a leading role in all stages of the trigger change circle, especially in stimulating producers' interest as well as in the implementation stage.

Overall, the role of the private advisors in motivating farmers was crucial since they disseminated valuable information about the innovation, helping farmers' first assessment and decision making through information seminars and personal contacts. According to the advisors the frequency of seminars usually depended on the commitment of the elected Board of each cooperative to promote the innovation. The number of farmers who attended the seminars was often determined by the strength of the influence cooperatives exert on their membership. Advisors emphasized the need for more training activities and increased farmers' participation in trainings. Moreover, information activities through personal discussions provided peach growers with detailed information about the implementation process of the method and evidence of its effectiveness (see narratives). Furthermore, the leading independent company played a significant, indirect role in the dissemination of the innovation through the provision of information and documentation data to the authorities, which also resulted in the inclusion of the method in the agri-environmental measures. Therefore, it assisted, in terms of farmers' financial motivation for adoption, by contributing to the creation of an institutional environment enabling them to adopt the innovation. Nevertheless, while producers continuously exchanged opinions with advisors and influenced each other, occasionally they also asked the Department of Deciduous Fruit Trees of Naoussa about the effectiveness of the method.

Reaching effectiveness, however, is a major challenge for the actors engaged in the innovation, since on the one hand, a considerable number of small holders abandons farming, thus leaving their land uncultivated, and discouraging their neighbours from adopting MD and, on the other hand, exceptional weather conditions during the last cultivation season let producers down, intensifying, in turn, fears for further losses of income and discouraging new undertakings. Producers' reservations make them adopt a wait-and-see attitude, which slows down the pace of adoption and prevents positive outcomes from becoming more visible. The inclusion of the MD in the agri-environmental measures and the relevant subsidy constitutes a strong incentive for adoption, alleviating (some of) these fears. But at the same time the lack of knowledge and lack of interest to participate in information/training activities hinders the diffusion of the innovation. According to the advisors the first adopters were producers who in general set high quality standards as regards the outcome of their work and, being well connected with networks and well informed, they were able to capture the trends in the markets. The local actors recognized that producers' participation in training varied considerably, depending on the effective organisation of such activities and especially the willingness and the ability of the local cooperatives to influence farmers' attitudes and decision-making. Moreover, it was noticed that the involvement of certain actors in the endorsement of the innovation was poor, especially in the very beginning of the process, and that the links between the local AKIS actors remained weak. But the critical challenge for the advisors involved in the development of the innovation is that the flow of information to farmer's remains slow mainly due to the fact that the number of advisors activated is not enough to cover the needs of producers.

In this respect, the role of the European and national policies is critical in two ways: The first one concerns the fact that the inclusion of the MD in the agri-environmental measures foresees the provision of advice to adopters. This is important since it is the first time that the implementation of an agri- environmental measure is connected with the provision of advice, thus supporting the recognition and enhancing the role of advisors. The second concerns the expected activation of the national Farm Advisory System and the setting of a working framework for farm advisors. There are many expectations concerning the operation of FAS; all the local AKIS actors pointed the urgent need for qualified advisors in order to boost

developments in the farming sector, and as one of them said: "advice is the missing element that will allow for the continuous improvement of quality systems".

5.1.2.3 Transformation of advisory landscape

The advisory landscape of the innovation is formed by the independent Adv. Co. and the collaborating cooperatives/producers' groups. Other actors/organizations playing a role are the two other independent advisory companies in the area which also collaborate with producers' groups and a growing number of input retail stores whose clientele comprises primarily individual farmers. The importance of the input shops for the MD lies in their number and proximity to individual farmers, particularly those that they are not members of cooperatives.

The three independent advisory companies involved in MD are also involved in the development, supervision, and implementation of quality systems, carrying out studies, providing technical advice and helping agri-food enterprises in realizing developmental projects. They collaborate with several cooperatives, hiring their services in order to offer their members advanced technical advice. Moreover, some cooperatives are engaged in farm supply trading and/or consultancy services as for example the Integrated Administration and Control System (IACS) and access to EU programmes. The Department of Deciduous Fruit Trees of Naoussa as a public research Institute does not employ advisors but all its researchers occasionally provide advice to farmers and producers groups on demand. The importance of the innovation for these actors varies significantly: six of them declared that it was very important and one that it was not important at all.

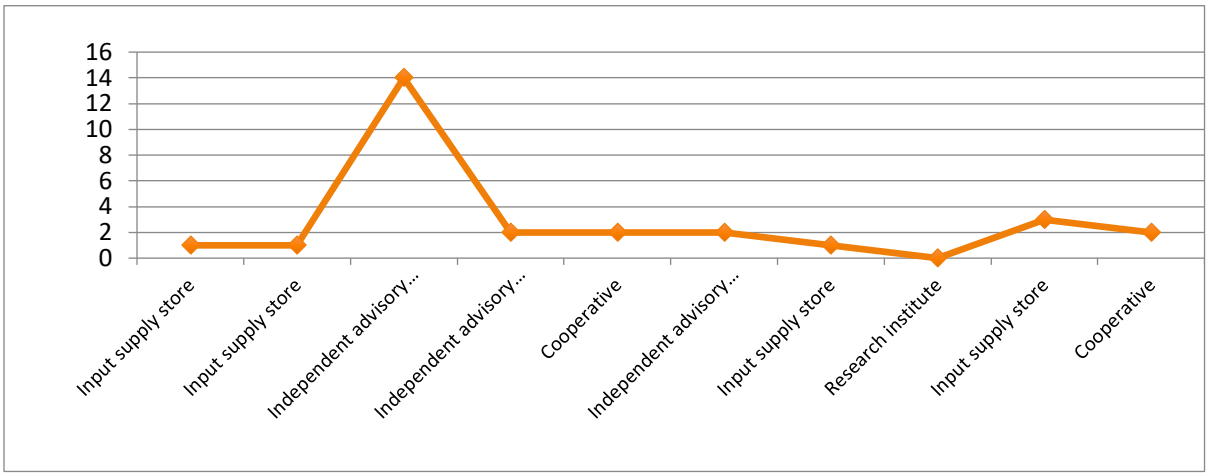
The characteristic of these organizations as regards their in house R&D facilities (back-office equipment), the numbers of their stuff and advisors and their qualifications are described in the Table 6. Back office investments in relation to the MD were included in the plans of six of the actors/organizations, concerning scientific experiments in farms, the development of a Decision Support Tool as well as further collaboration with independent advisory companies on the part of the local coops.

Table 6: In house R&D facilities and human resources of the advisory organizations (MD)

Description	Experimental facilities	Knowledge platform or data base	Number of staff	Number of staff in back-office activities	Number of in front-office activities	Advisors with university (%)	Number of certified advisors on EU-related standards	Number of certified advisors on national standards	Number of certified advisors on other certificates	Advisors with less than 3 years professional experience (%)	Advisors with more than 12 years professional experience (%)
Input supply store	No	No	1	0	1	100	0	0	0	0	100
Input supply store	No	No	1	0	1	100	0	0	0	0	100
Independent advisory company	No	Yes	17	8	13	100	0	14	9	15	70
Independent advisory company	Yes	Yes	23	5	15	100	0	15	15	10	40
Cooperative	No	No	6	0	2	100	0	2	0	0	0
Independent advisory company	No	No	4	2	4	75	2	2	0	0	50
Input supply store	No	No	4	1	1	100	1	1	0	25	0
Research institute	Yes	Yes	5	5	0	100	0	0	0	0	0
Input supply store/ Consultancy	No	No	6	2	6	100	3	4	2	0	50
Cooperative	No	No	2	0	2	100	0	0	0	0	0

Source: Fieldwork, 2018

Figure 29: Number of advisors working on the MD



Advisors from seven of the interviewed organizations were engaged in training activities, which were delivered from input industries (3 cases), organised within the company by more experienced and knowledgeable advisors (2 cases) or, in the case of coops, from independent advisory companies (2 cases). The duration of training was on average 10.2 days/year on issues concerning new chemical products, requirements of quality systems, European and national regulations, cultivation practices, extension methodology, etc.

Figure 30: Most important methods of advisory work

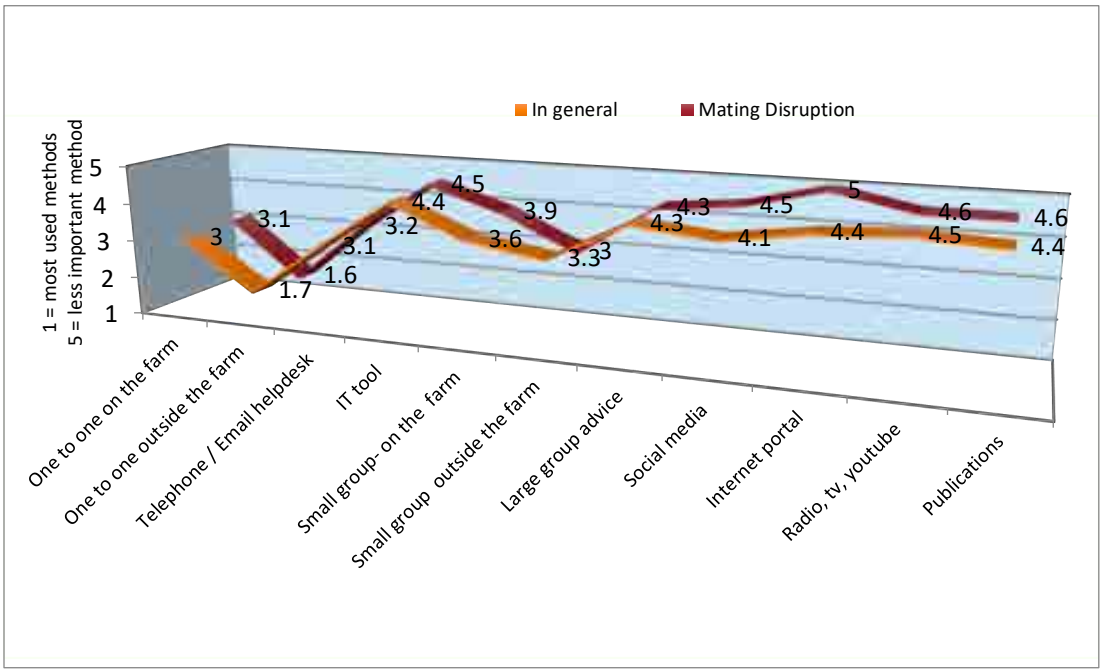
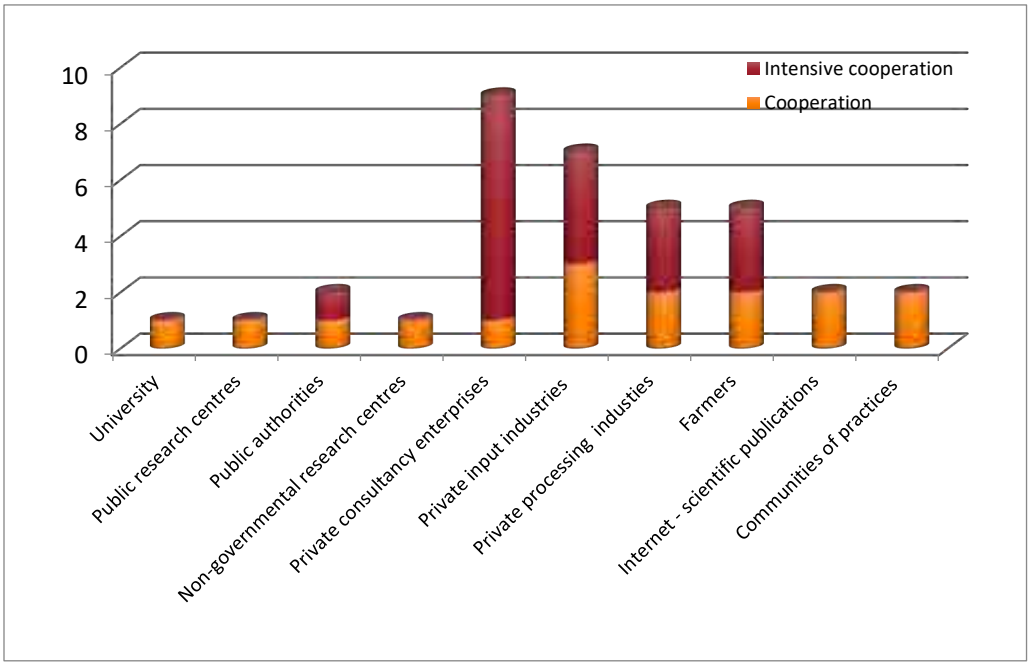


Figure 31: Important sources of knowledge, Mating Disruption



The limited number of advisors working in the MD constitutes the main challenge for the organizations involved in the innovation since the presence of advisors in the fields is absolutely necessary, especially when weather conditions are conducive to diseases' outbreaks. To this end, the activation of the measure of the Farm Advisory System will be beneficial for both farmers and advisors working on the implementation and dissemination of the innovation.

5.2 Case 2: The dissemination process of avocado in Chania, Crete

5.2.1 Findings related to the Farmers' survey

5.2.1.1 Farmers' profile and farm structure

According to the survey data the large majority of the interviewed farmers are owners or co-owners and managers of the farm holdings (89% of the interviewees; Figure 32).

Figure 32: Farmer position in the farm (avocado)

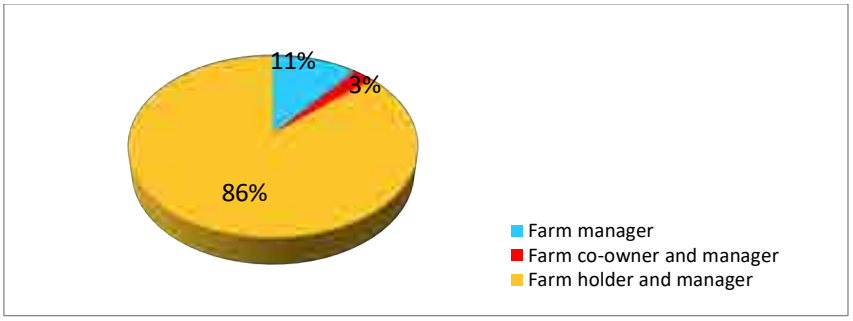
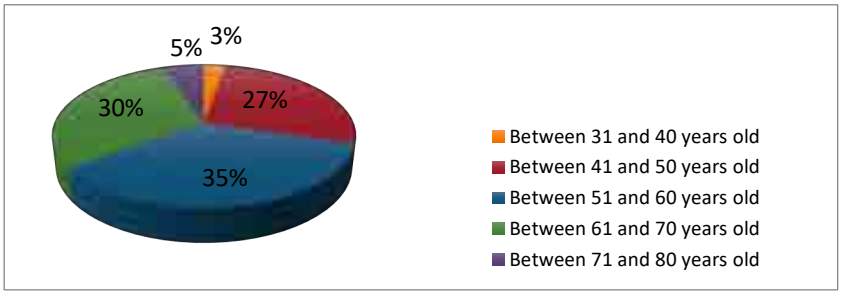


Figure 33: Age of farmers (avocado)



Most of them are experienced farmers (95% professional farmers for more than 15 years;; 70% of them are above the age of 50 years old (Figure 33). The vast majority of them (80%) have been employed outside the farming sector, practicing several other professional activities. The range of professions varies considerably: freelancers, public and/or private sector employees (including tourism and recreational industries, food industry employees, chemists, engineers, military officers and agronomists).

Figure 34: Farming experience (avocado)

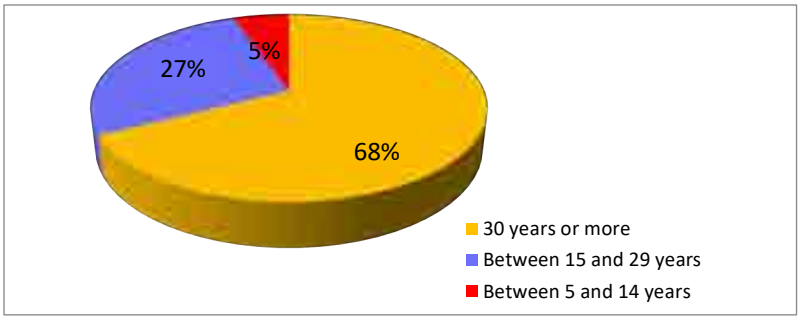
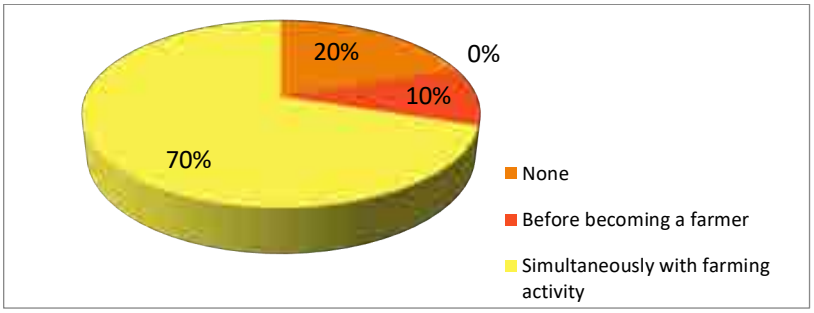
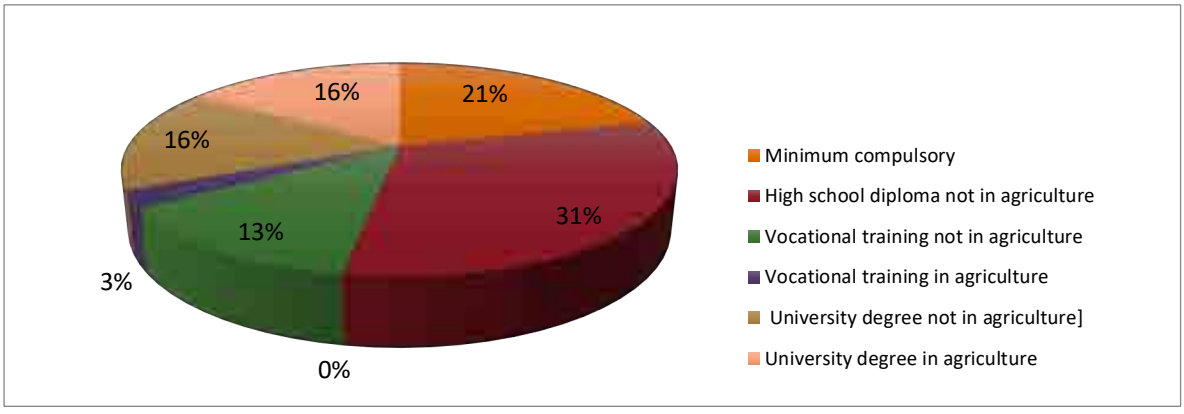


Figure 35: Non-farming professional experience (avocado)



As far as the interviewees' educational level is concerned only 3% of them (one farmer) have vocational training in agriculture, while 16% hold a university degree in agriculture (Figure 36). Additionally, almost 30% (11 farmers) have participated in training courses (on topics such as olive and avocado management practices, beekeeping) during the previous year. With reference to the existence of a successor, this is the case of six out of 13 farmers (35%) aged above 60 years old who participated in this survey.

Figure 36: Educational level (avocado)



All farm holdings are identified as family holdings. The farmers cultivate, on average, 8.73 ha (323.3 ha in total; own land 86.2%), mainly with olives (57% of the total cultivated land, of which 33% organic) avocado (16.7%, of which 38% organic) and citrus plantations (15.6%, of which 6.6% organic). The irrigated land

corresponds to 54.7% of the total cultivated land. Over 41% and13.8% of the total cultivated land is irrigated by sprinklers and by drop irrigation, respectively.

Table 7: Use of digital devises (avocado)

Activity	Digital tool	Frequency	Percentage
Management	Smartphone	11	29.7
Management	Tablet	4	10.8
Management	Laptop	9	24.3
Management	Desk computer	18	48.6
Subsidies management	Desk computer	1	2.7
Crop management	Tablet	1	2.7
Crop management	Desk computer	3	8.1

Almost half of the farmers make use of desk computers to deal with farm management issues, while a considerable number of them make use smartphones as well (Table 7). Over 92 % of the farm holdings employ hired workers temporally (Table 8). More than 50% of them make use of family workforce both temporarily and on a permanent basis.

Table 8: Farm labour force

	Frequency	Percentage
Hired workers permanent	11	29.7
Hired workers temporary	34	91.9
Family workers full time	20	54.1
Family workers part time	21	56.8

Over 80% of the farm holdings channel their products in the markets through traders or the local cooperatives. Three farmers were engaged in other than farming activities (agro-tourism and contractual works using production means of the holding) with corresponding revenues being less than 50% of the total revenues of the holding. All farmers but one received subsidies accounting for less than 25% of the total income generated by the holding.

5.2.1.2 Farmers' attitude towards innovation and change

Private sector agronomists employed in input supply stores and peers are the most important advice providers of the farmers, followed by public research and education institutes and farm based organizations (Figure 37). Some farmers are also supported by public sector local services, which mainly correspond to the local Directorate of Agricultural Economy and Veterinary.

Figure 37: General micro-AKIS (avocado)

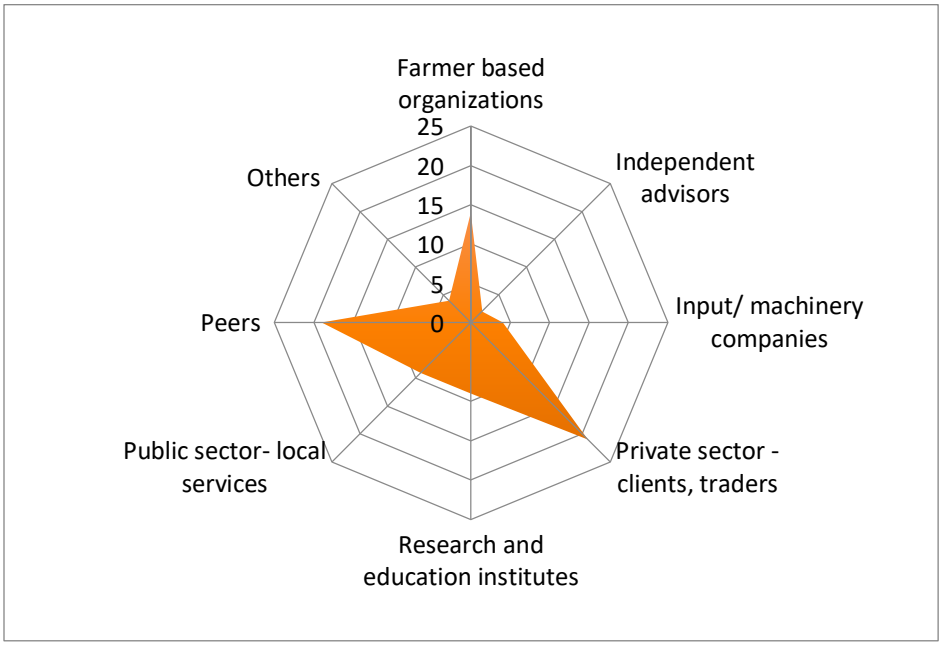
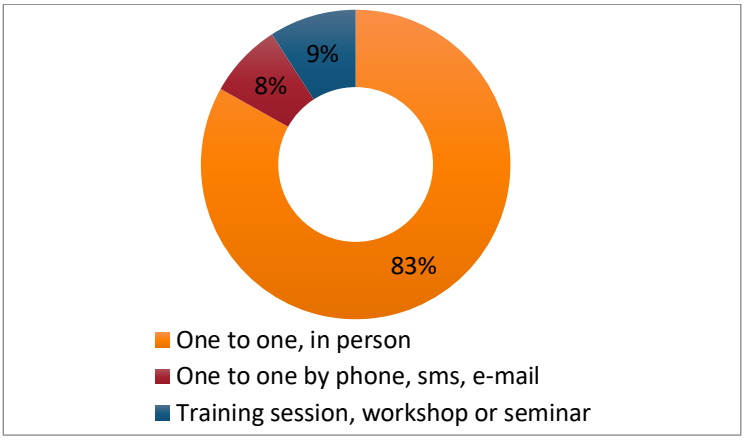


Figure 38: Advisory methods (avocado)



Individual -one by one- in person contact is the most widely used communication method (Figure 39) including discussions mainly on technical issues (Figure 40). Farmers' knowledge on farming issues derived from discussions with others, the Internet and observations of other farms (Figure 39). In general, farmers are not satisfied by the quality of advice they get, recognizing "the need for accurate and timely information" and wishing for knowledgeable advisors able to suggest justified solutions instead of opinions based (or not) in experience.

Figure 39: Important sources of knowledge (avocado)

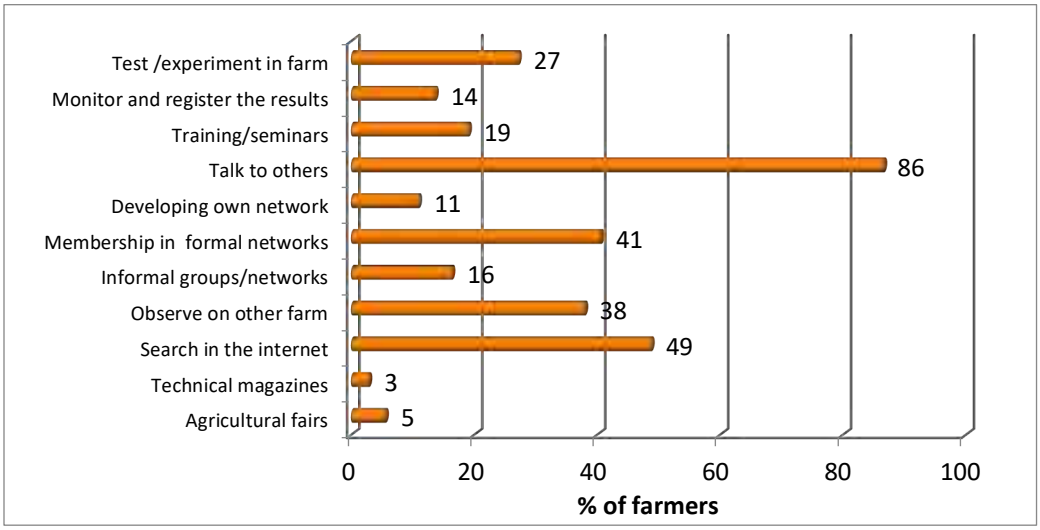
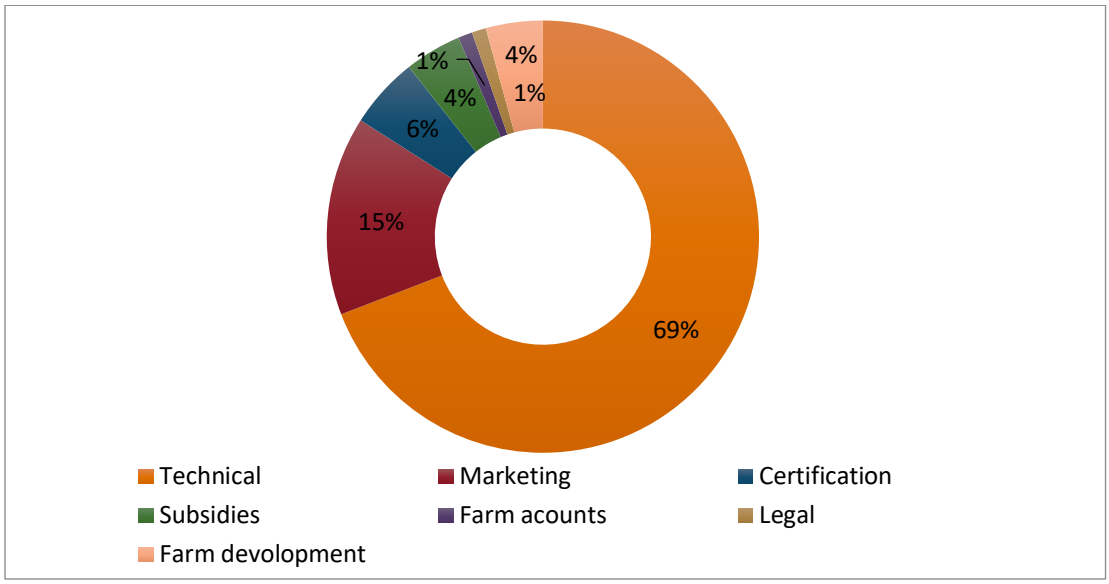


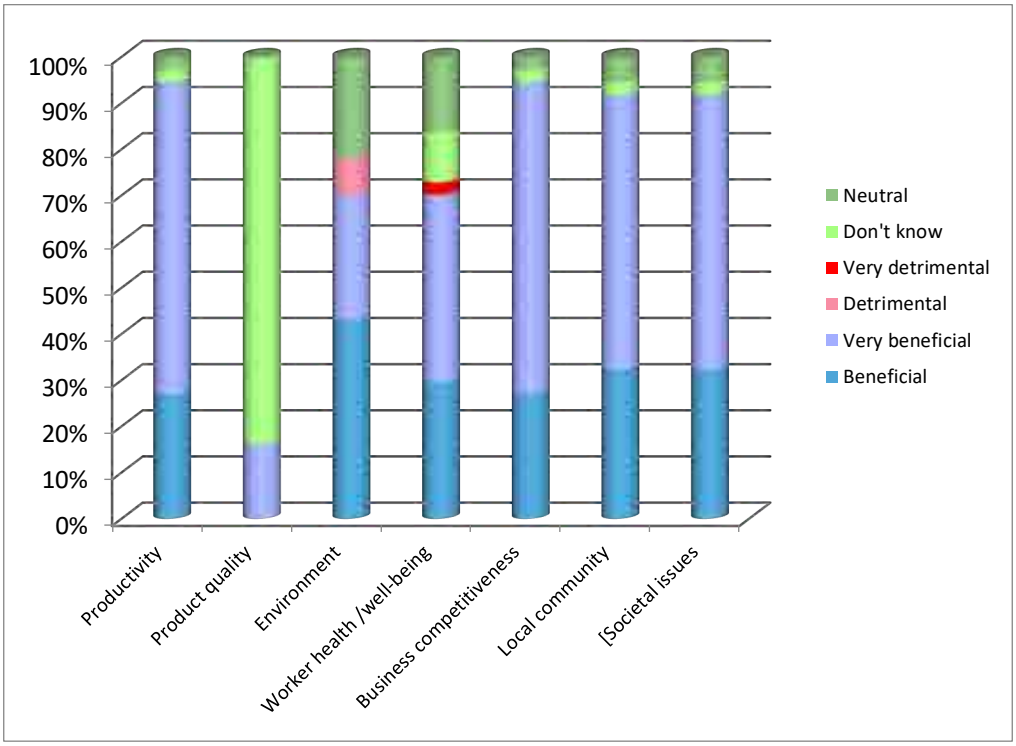
Figure 40: Farmers' needs of advice (avocado)



5.2.1.3 *Farmers' innovation paths and trigger cycle change model*

The sample of farmers consists of 28 adopters and 9 non-adopters. The main reason for adoption is the increasing demand -and subsequently prices- of avocado globally in combination with the crisis in the orange (primarily) and olive oil (secondarily) markets. In fact, only farmers who are near retirement, without a successor or farmers who practice farming only for self-consumption have not been engaged in the cultivation of avocado so far. In the last years farmers are trying to cultivate avocado even in marginal fields that do not meet the necessary soil conditions for planting avocado trees, thus, indicating their urgent need for alternative crops to secure sustainable incomes.

Figure 41: Evaluation of the crop (avocado)



Raising awareness about the cultivation of avocado in Chania was a long process since the early 1970s, involving several private and public actors (Figure 42). The first adopters who stimulated the interest of other farmers for avocado were an individual producer, who first cultivated and exported avocado in France, and a private company, which tried to established commercial avocado plantations but soon it stopped its activities. In parallel the public Institute of Olive Tree, Subtropical Plants and Viticulture started experimenting with avocado under the efforts of its director to promote its cultivation. In 1985 a second period of farmers' awareness started since in the framework of the Integrated Mediterranean Programmes (IMP) the cultivation was subsidized. Then the crisis in the markets of citrus and subsequently the increasing demand of avocado globally, especially after 2004, attracted again the interest of farmers to the crop.

Over these years, the most widely used communication method for raising awareness and assessing the cultivation of avocado was one to one in person contact among the actors involved (Figure 43 and Figure 46). Peer-farmers had leading role in awareness activities; during the assessment stage the role of researches was strengthened since farmers searched for valuable knowledge and justified information to

support their decision (and their investment) (Figure 44 and Figure 45). Finally, the most valuable sources of knowledge for farmers were discussions they had with others, their conclusions from running tests and experiments in their farms and their observations on other farms (Figure 48).

Figure 42: Initiation of awareness (avocado)

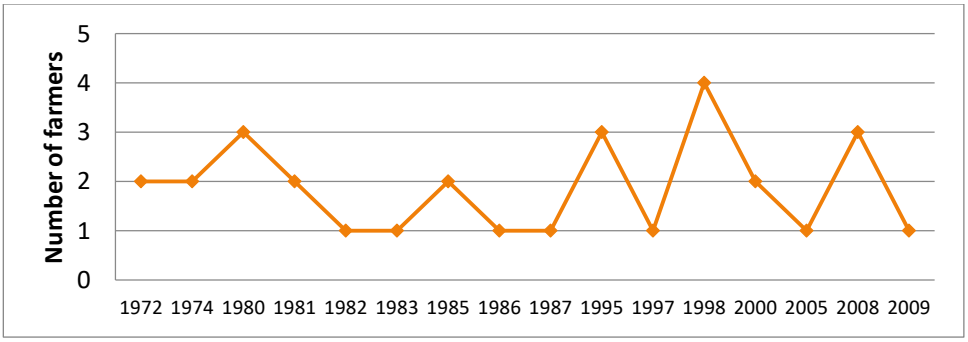


Figure 43: Communication methods (avocado)

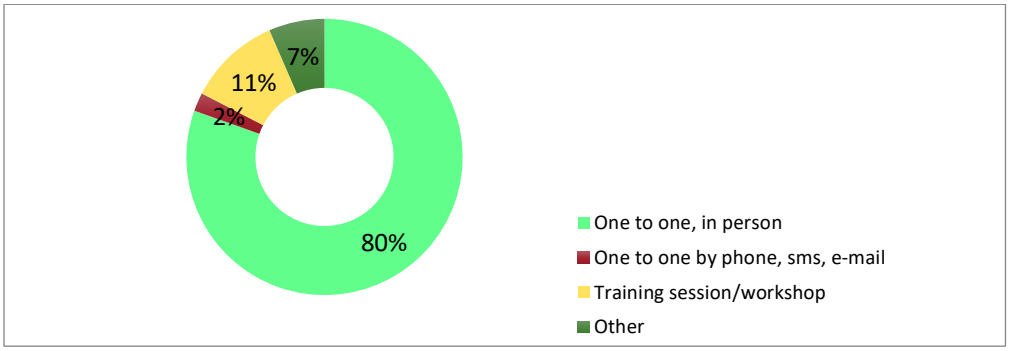


Figure 44: Actors – awareness (avocado)

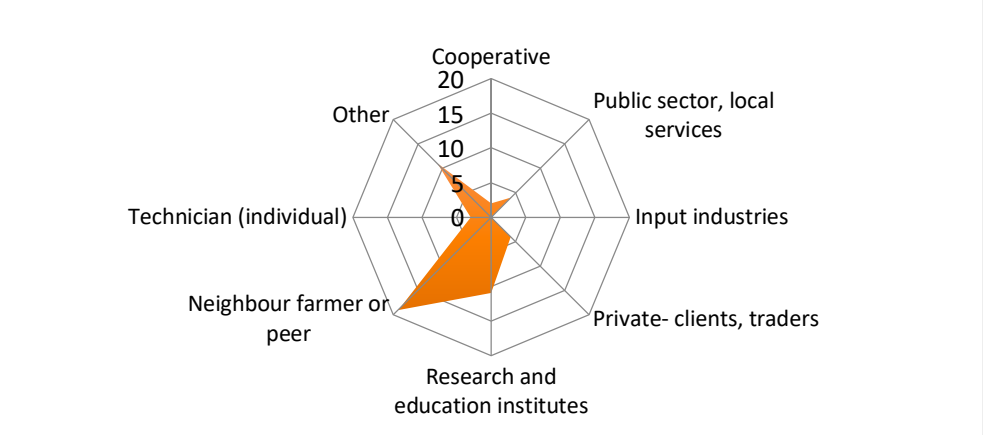
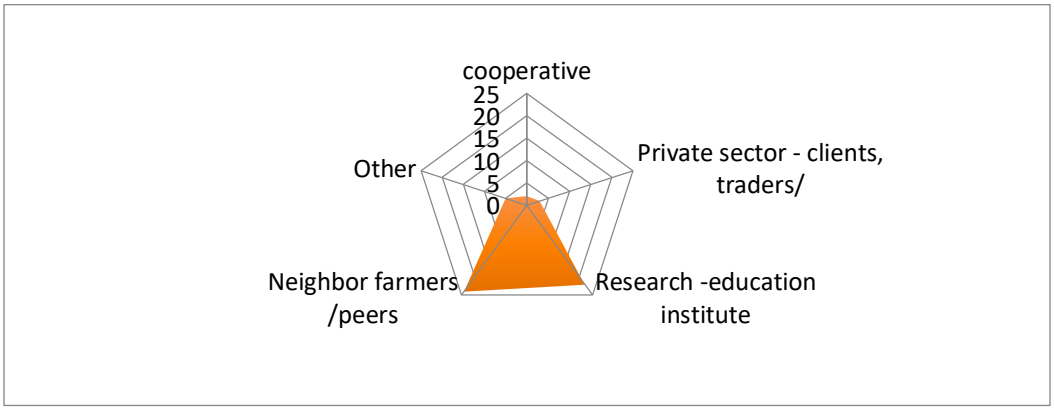


Figure 45: Actors assessment (avocado)



The time lag between awareness and the initiation of the active assessment process was very extended (Figure 47), indicating that in most cases the awareness events did not trigger immediately the farmers' interest for the innovation. Both farmers and key informants indeed claim that most farmers started thinking the adoption of avocado when they dealt with adverse conditions in the markets of citrus and olive oil.

Figure 46: Advisory methods – assessment (avocado)

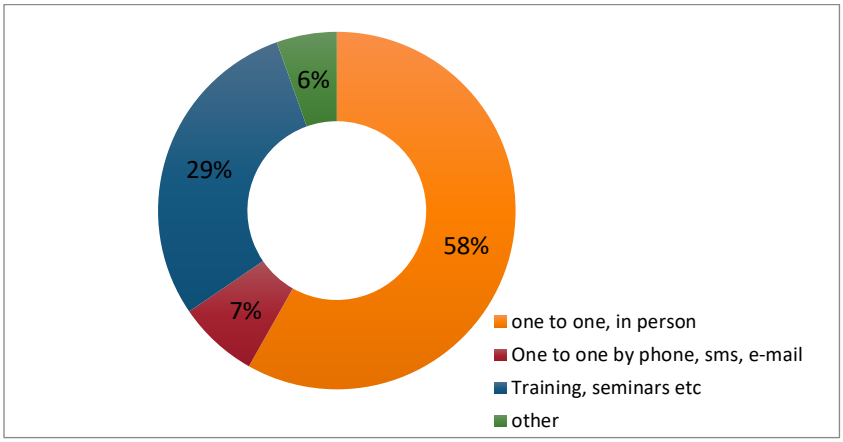


Figure 47: Time lag between awareness and active assessment (avocado)

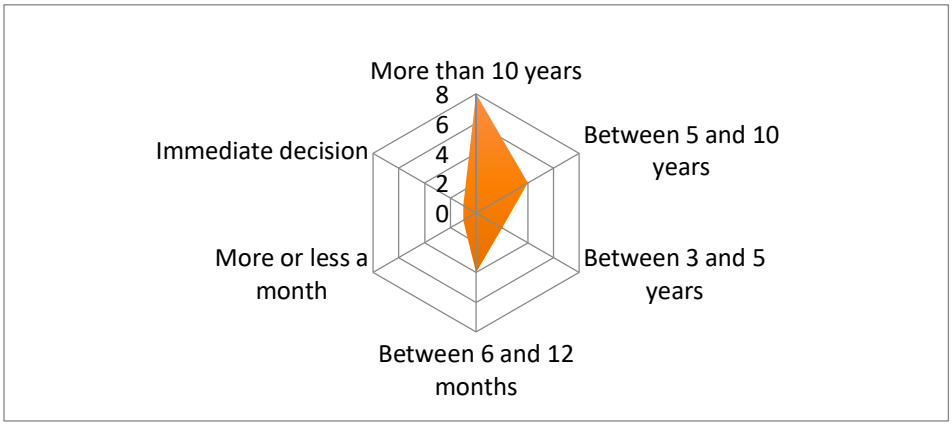
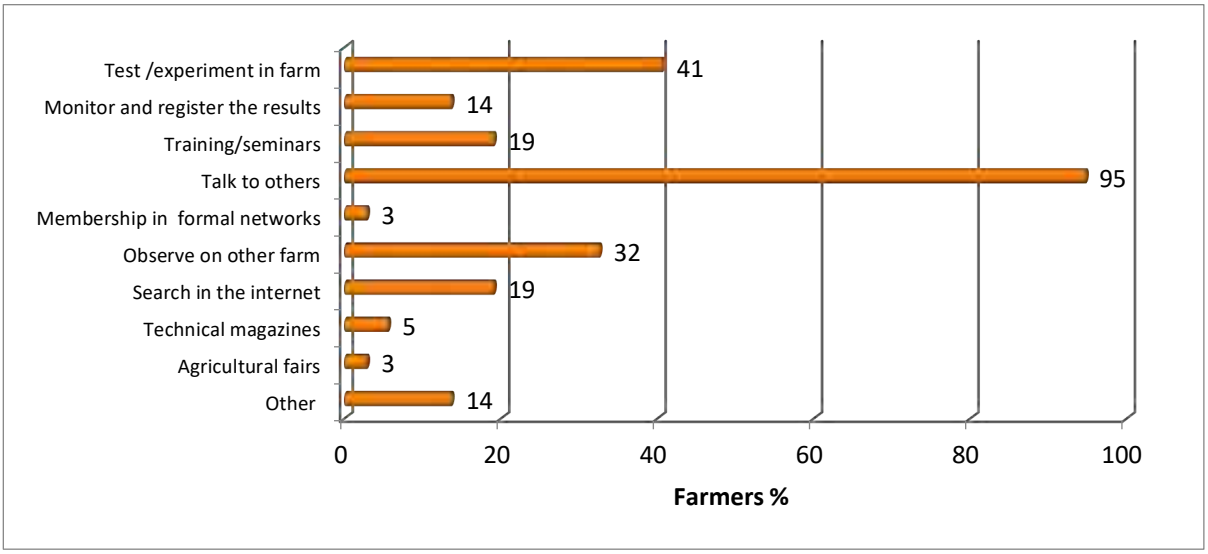


Figure 48: Important sources of knowledge, assessment (avocado)



The factors the farmers took into account in order to get involved in active assessment concerned farm competitiveness and family income as well as farmers' personal satisfaction. The cost of the establishment of the crop was considered bearable, in general, though some farmers pointed that this depends on the origin and the quality of the seedlings. The uncertainties they faced and the risk they undertook concerned climate change (19%), the lack of knowledge and support (49%) and prices volatility (11%), while the only significant barrier they recognized was the lack of land suitable for the cultivation.

The most important factors motivating farmers to adopt the innovation derived from the need to secure and increase their family income (67%); other motivations concerned their personal fulfilment and satisfaction as well as the need to learn and respond to professional challenges. During the implementation process farmers were supported mainly by other farmers, followed by input suppliers, the local public services and local cooperatives and clubs (Figure 49). Discussions and experimentation at their own farms continued being their most important sources of knowledge during the implementation stage.

Figure 49: Farmers' activities, implementation (avocado)

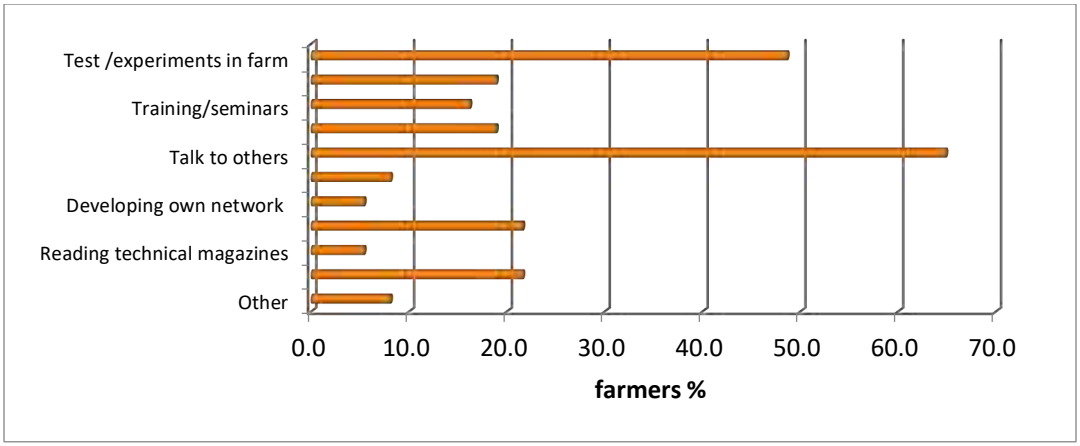
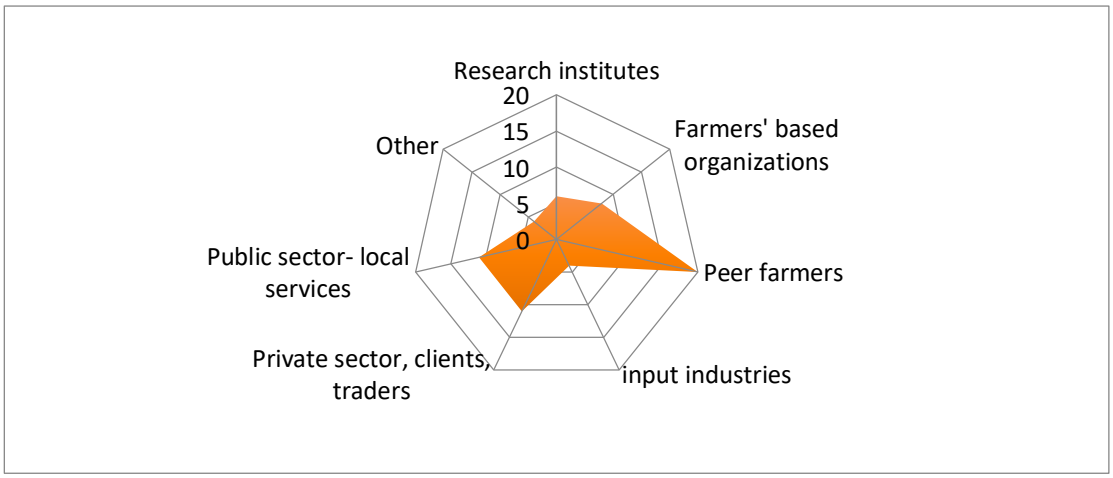


Figure 50: Actors, implementation (avocado)



5.2.1.4 *Farmers' innovation micro-AKIS*

In the case of avocado peer farmers emerge as important actors disseminating information and knowledge throughout the innovation process (Figure 44, Figure 45, Figure 50). Research institutes initiated campaigns to raise awareness but their role was more critical during the assessment stage, when farmers sought guidance and justified information to support their decision concerning adoption - or not. During the implementation stage local departments of public services and input suppliers emerge as equally important actors. Therefore, the picture of the farmers' micro AKIS during the implementation stage of the innovation resembles their general micro-AKIS, pointing to the influence that input suppliers exert to farmers within the dependency path, mainly because of their proximity and frequent contact.

In general, concerning the interviewed farmers' needs and the outcome of their interaction with public and private advice suppliers, they pointed out that:

- There is a knowledge gap around the cultivation of avocado since its introduction in the area. There is a lack of a strategic plan and thus of investment in knowledge generation on the part of the State and its respective public organizations/ services. In the past this resulted in crop failures due to inappropriate propagation material and incorrect cultivation practices, since avocado growers had no access to technical advice based on properly validated scientific knowledge. The public organizations/ services, in general, are not able to provide proper answers to growers' questions; the seminars they regularly organize are not enough to guide the growers so as find solutions on their cultivation problems.
- Because of these failures, many of the first avocado growers almost abandoned the cultivation to turn again to it only when they were 'forced' by the worsening conditions prevailing in the orange and olive oil markets.
- There is urgent need for advice from experts and lifelong education/training activities, with emphasis especially on the young farmers' training. Such luck undermines sustainability, since input suppliers based on farmers' ignorance promote the use of (unnecessary) inputs. On the other hand, uneducated farmers not always fully perceive the need to protect the environment and consumers' health and take measures against the climate change or, even if they understand, they are not motivated enough and they do not know how to manage their crops properly.

- Private input suppliers are just traders and not sufficiently reliable as advice providers.
- The absolute failure of the local agricultural cooperatives to support farmers, because of lack of conciliation and concerted action, especially as opposed to some successful cooperatives in the Northern Greece which play a leading role in the exportation of certain agricultural products.

5.2.2 Findings from the AKIS experts interviews and advisory organisations survey

5.2.2.1 Advisory landscape in the focus region

The advisory landscape of the farmers cultivating tree-orchards in Chania Prefecture is formed by private, public and farmer-based actors/organizations activated not only at the local or regional but also at the national level (Table 9); they also characterized by the fact that their primary mandate is not to provide advice to farmers.

Table 9: The advisory landscape in Chania

Organization	Type/ Scale of action
The Mediterranean Agronomic Institutes of Chania (MAICHs)	Intergovernmental organization/ International
Institute of Olive Tree, Subtropical Plants and Viticulture	Public research institute/ National
Directorate of Agricultural Economy and Veterinary	Public organization/ Local
Organic Producers' Cooperative	Farm based organization/ Regional
Agricultural Cooperative of Chania / Orange and avocado producers' group	Farm based organization/ Local
Input supply shops/ Nurseries	Private sector –Local / Local - Regional
Individual consultants	Private sector – Local

Source: Fieldwork, 2018

- The Mediterranean Agronomic Institutes of Chania (MAICH) is a part of the CIHEAM, a Mediterranean intergovernmental organization. The Institute aims at providing post-graduate specialized education on sustainable development, networked research and the facilitation of regional debate. Two laboratories of the Institute- the Soil Science and Plant Diagnostics Laboratory and the Analytical Chemistry Laboratory –provide farmers with agronomic services on a fee. Advice is embedded in the services provided. Advice concerns cultivation practices, plant varieties, guidelines for plantation establishment, the use of fertilizers and irrigation.
- The Institute of Olive Tree, Subtropical Plants and Viticulture is a public research institute that carries out applied research. It is a part of the General Directorate of Agricultural Research (former N.AG.RE.F.) of the Hellenic Agricultural Organization (ELGO) "DIMITRA". The Institute collaborates with municipalities, cooperatives and individual farmers in its effort to disseminate research outcomes and respond to requests for support on technical issues (usually requiring further examination). Normally, it has a limited advisory role; however, it is not unusual for farmers to contact the Institute. Advice is provided free of charge but farmers have to pay the cost of relevant analyses.

- The local Directorate of Agricultural Economy and Veterinary is a public service under the Ministry of Interior although following the chain of command stemming from the Ministry of Rural Development and Food. It collaborates with local municipalities, implementing national and European policies. Phytosanitary and veterinary inspections, the monitoring and control of plant diseases and plant protection products, the surveillance of all kinds of enterprises involved in the agrifood chain, etc. are included in its mandate. The service provides advice to farmers upon demand and free of charge and, occasionally, organizes or participates in information events for farmers and the general public.
- The Organic Producers' Cooperative is engaged in the trading of organic products, focusing especially on avocado. It supports its 40 members through collective input and propagation material supplies. Its membership includes agronomists who provide advice and participate in workshops and training about the cultivation of avocado addressing wider farmers' audiences.
- The Agricultural Cooperative of Chania /Orange and avocado producers' group: provides advice amongst other activities such as IACS (Integrated Administration and Control System) declarations and/or preparing applications for the organic farming program on behalf of farmers, etc.

5.2.2.2 Key players of advice for the innovation area in the focus region

The advice organizations that played an important role at several stages of the dissemination process of this innovation concern public and farmer based organizations as they were described in the previous section. Given that their primary mandate is not the provision of advice to farmers, it is worth noting that in some cases the significance of their contribution lies mainly in the efforts of individual actors/ employees rather than in the implementation of any (governmental) policy on the cultivation of avocado.

The Institute of Olive Tree, Subtropical Plants and Viticulture was the critical player in the initiation of the trigger change circle in the case of avocado, through the establishment of experimental plantations, and the dissemination of research results for more than a decade since the early 1970s. At that time the Institute resolutely affected the decision of the first adopters, partly due to the efforts of its director, who was a well-respected and influential actor locally. Nevertheless, some of these early adopters soon found themselves dealing with severe cultivation and marketability problems and the lack of knowledge; thus some of them started abandoning the cultivation or decreasing significantly the cultivated area. In parallel the Institute gradually stopped playing its leading role, because of administrative problems and lack of adequate human resources. However, its impact is still evident since the majority of the nursery owners and researchers who have played a key role in the dissemination of avocado the subsequent years were earlier employed or collaborated with the Institute. It is quite characteristic the example of a well-respected academic researcher - today a pensioner- who has been providing advice to avocado producers (nowadays through his participation in seminars) since 1970s, when he started collaborating with the Institute as a young researcher. The situation in the Institute started changing recently as new scientific staff, willing to collaborate with other actors to support avocado producers, has been recruited.

To this end, a scientist of the Institute participates in an informal working group along with three other agronomists employed in the local Directorate of Agricultural Economy and Veterinary Services, the local Organic Producer's Cooperative, the Mediterranean Agronomic Institute and the above mentioned retired academic. This group aims at supporting avocado growers by putting forward project proposals, which the

regional government will be invited to accept and realize. Their cooperation includes regular meetings on a voluntarily basis and the organization of information events and training for farmers.

The abovementioned actors recognize the importance of the establishment of permanent communication channels with farmers. They also point to the significance of peer–to-peer exchanges among avocado producers but most of them also highlight that, these exchanges, which often take place in coffee shops, result in the perpetuation of false cultivation practices. In addition, they agree that this producers' communication behaviour accelerates the dissemination of avocado; overall though the rapid expansion of the cultivation is mainly attributed to worsening conditions in the citrus and avocado markets. Furthermore, some of the interviewees point out the lack of public strategy as regards the empowerment of avocado producers to deal with fluctuating demand and price volatility as well as the inability of the authorities (or lack of willingness) to take measures to alleviate the consequences of climate change, especially in relation to water management.

Furthermore, the interviewed actors identified severe deficiencies in public policies to the support that both avocado producers and advice providers need. They especially highlight the heavy bureaucratic structure and attitude of the public services "characterized by a 'down-at-heel' administrative culture…. focusing on subsidies instead of development". They also recognize that "scientists who provide advice should be supported". Scientific platforms and databases with useful research material and tools, such as soil maps, are needed and they should be available to advice providers". Some actors also consider that "the State could organize special training for advisors to enable them to obtain a holistic view [of advice] and provide farmers with coherent and comprehensive advice on avocado" and that, in any case, "an advisory system should be able to gain farmers' trust…". Finally, some of the interviewees concluded that they "do not anticipate any change in advice provision", although there is qualified scientific staff willing to help avocado growers in Chania.

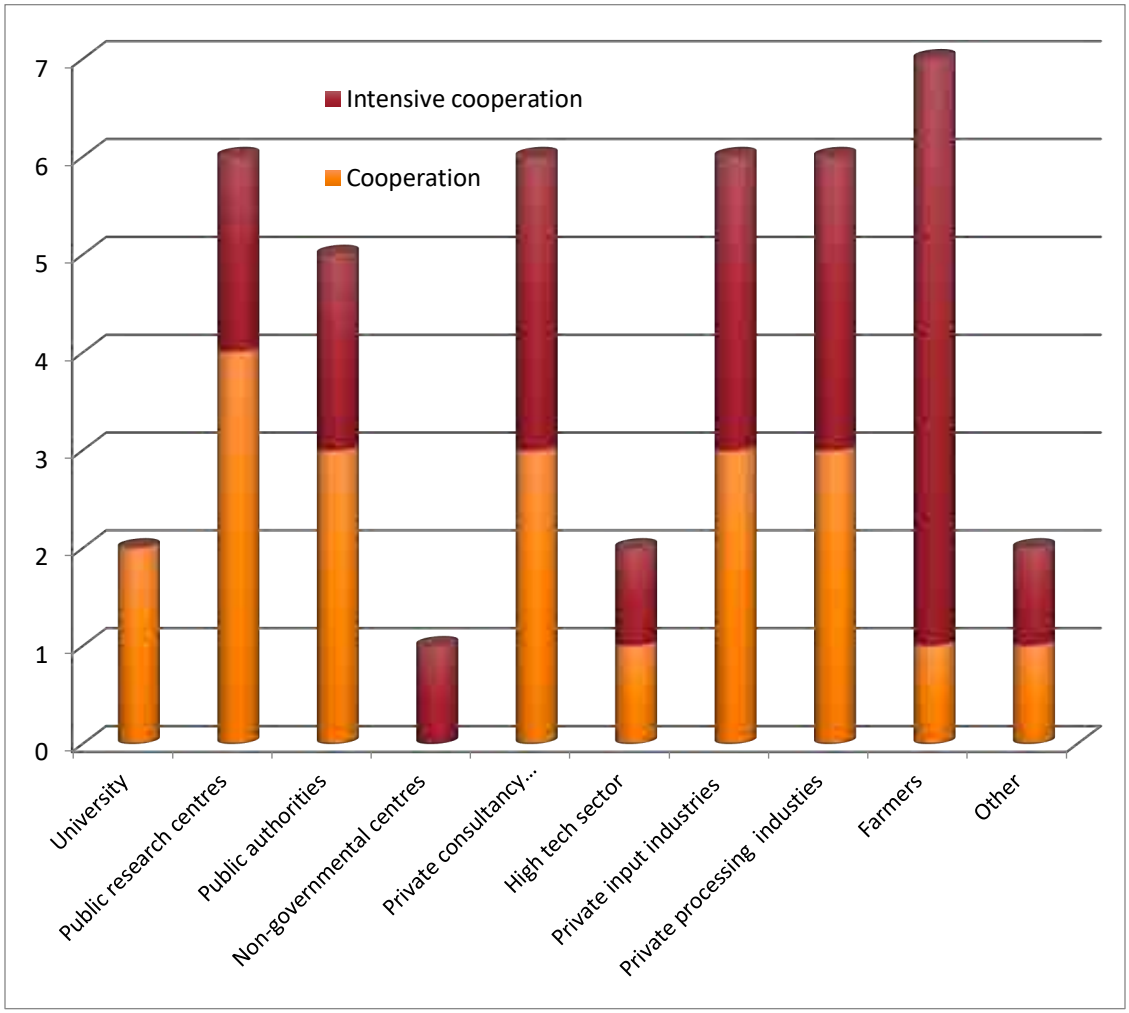
5.2.2.3 Transformation of advisory landscape

As abovementioned, the advisory landscape in the case of avocado is formed by some public and farmer based organizations and numerous nurseries and input supply shops, two of which were selected for interviews based on the references made to them by the interviewed farmers.

Concerning the characteristics of these entities as regards their in house R&D facilities, four of them have experimental facilities, while one owns a database or knowledge platform. As far as advisors are concerned, none of them employs more than one agronomist to provide advice with advisory work being only part of their general tasks. Therefore all agronomists seem to be engaged in both front and back office activities. Four of these entities invest in scientific experiments in experimental stations and three in such activities in farms. None of the back and front office activities have been supported by the State.

All employed agronomists hold a university degree and are recognized as advisors on the basis of this degree. None of them is certified according to the European or other standards. Only one of the employed agronomists was engaged in training and educational activities during the last year (one seminar and postgraduate studies). Although the importance of the cultivation of avocado is growing over time no more than one member of their staff works on it. All entities provide advice on plant production and only two provide advice on marketing, certification and environmental issues. Advice is provided more often on the basis of one-to-one in person communication. Farmers, public research centres and public authorities are the most important sources of knowledge for the interviewed AKIS actors (Figure 51).

Figure 51: Important sources of knowledge, AKIS actors (avocado)



Source: Fieldwork, 2018

5.3 Case 3: The introduction of the cultivation of stevia in Karditsa

5.3.1 Findings related to the Farmers' survey

5.3.1.1 Farmers' profile and farm structure

According to the survey data the large majority of the interviewed farmers are owners or co-owners and managers of the farm holdings (94% of the interviewees; Figure 52).

Figure 52: Farmer position in the farm (stevia)

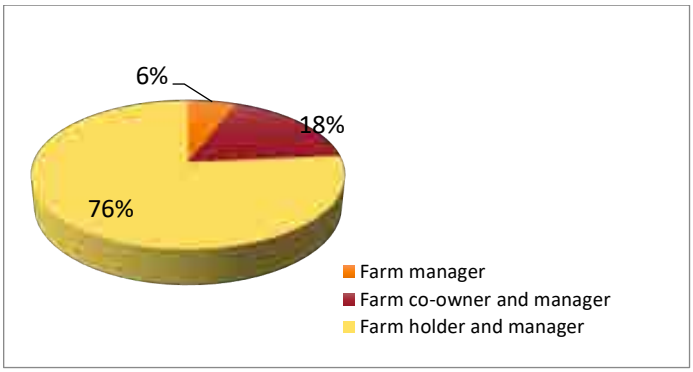
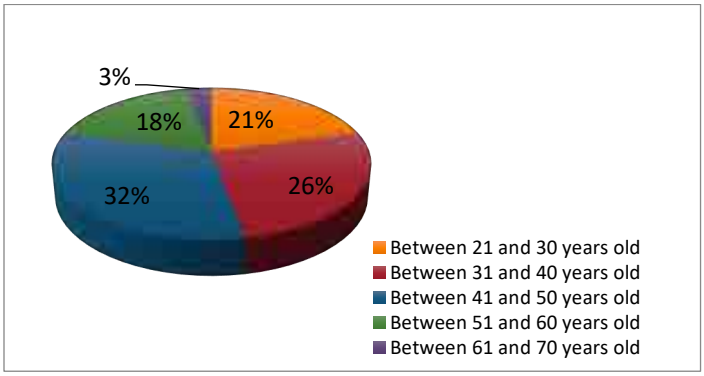


Figure 53: Age of farmers (stevia)



Most of them are experienced farmers (95 % professional farmers for more than 15 years (Figure 54); 57 % of them are above the age of 50 years old (Figure 53); one of them is above the age of 60, however, without a successor. Over 64% of farmers have been employed outside the farming sector in a range of professions such as: freelancers, public and/or private sector employees (including the tourism industry, technicians, car mechanics, etc.).

Figure 54: Farming experience (stevia)

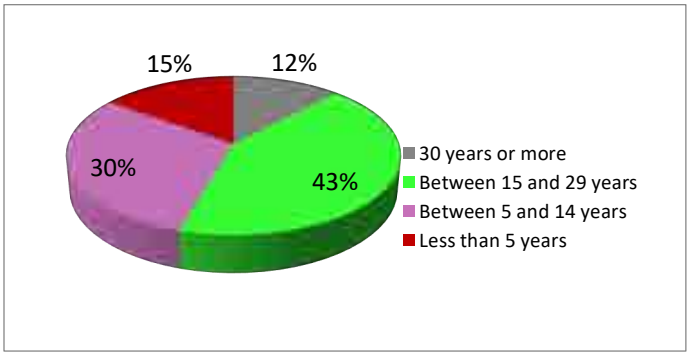
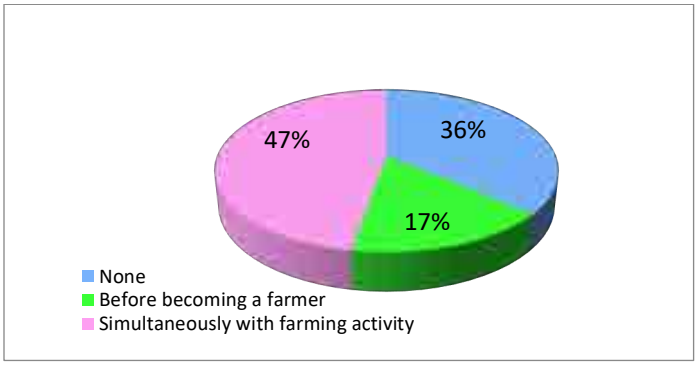
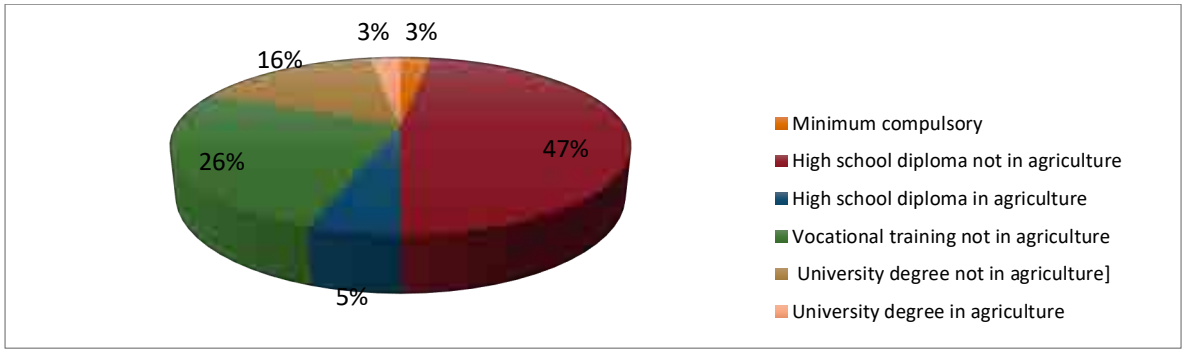


Figure 55: Non-farming professional experience (stevia)



As far as the interviewees' educational level is concerned none of them had vocational training in agriculture, while 3% held a university degree in agriculture (Figure 56). Additionally, 32% of them (11 farmers) participated in training courses (on topics such as beekeeping, cultivation of pulses and leguminous plants, cotton, vineyards and wine-making, etc. - including young farmers' training as well) during the previous year.

Figure 56: Farmers' educational level (stevia)



All farm holdings are identified as family holdings. The farmers cultivate 787.13ha in total, own land 51%, mainly with cotton (43.5%), leguminous (13%) and maize (13%) crops. The irrigated land accounts for 98% of the total cultivated land.

Table 10: Use of digital devises (stevia)

Activity	Digital tool	Frequency	Percentage
Bookkeeping	Smartphone	1	2.9
Bookkeeping	Laptop	7	20.6
Bookkeeping	Desk computer	9	26.2
Management	Smartphone	12	35.3
Management	Tablet	9	26.5
Management	Laptop	14	41,.2
Management	Desk computer	14	41.2
Subsidies management	Smartphone	13	38.2
Subsidies management	Tablet	6	17.6
Subsidies management	Laptop	12	35.3
Subsidies management	Desk computer	8	23.5
Crop management	Smartphone	5	14.7
Crop management	Tablet	2	5.9
Crop management	Laptop	3	8.8
Crop management	Desk computer	1	2.9

Smartphone, desk computer and laptop are the favourite digital devices that farmers use to be informed about subsidies and to deal with farm management issues respectively (Table 10). Over 80% of the farm holdings employ family workforce (full and/or part time), while almost 15% of them employ permanent hired workers (Table 11).

Table 11: Farm labour force

	Frequency	Percentage
Hired workers permanent	147	5
Hired workers temporary	676	23
Family workers full time	794	27
Family workers part time	735	25

Almost one third of the farm holdings channel their products in the markets through traders while an equal number sale farm production directly to the final consumers. Five farmers (14.7%) are also engaged in on-farm jobs (as machinery sub-contractors) with the revenues of four of them accounting for less than 25% of the total revenues of the holding. Over 91% of the farmers receive subsidies; for 30% of the sample (10 farmers) subsidies contribute more than 50% of the total income generated by the holding.

5.3.1.2 Farmers' attitude towards innovation and change

Private sector agronomists employed in input supply stores and a diverse group of actors (comprising peer farmers, friends and family members – including agronomists) are the key advice providers of the farmers (Figure 57). Cooperatives and other farm based organizations play a rather marginal role.

Figure 57: General micro-AKIS (stevia)

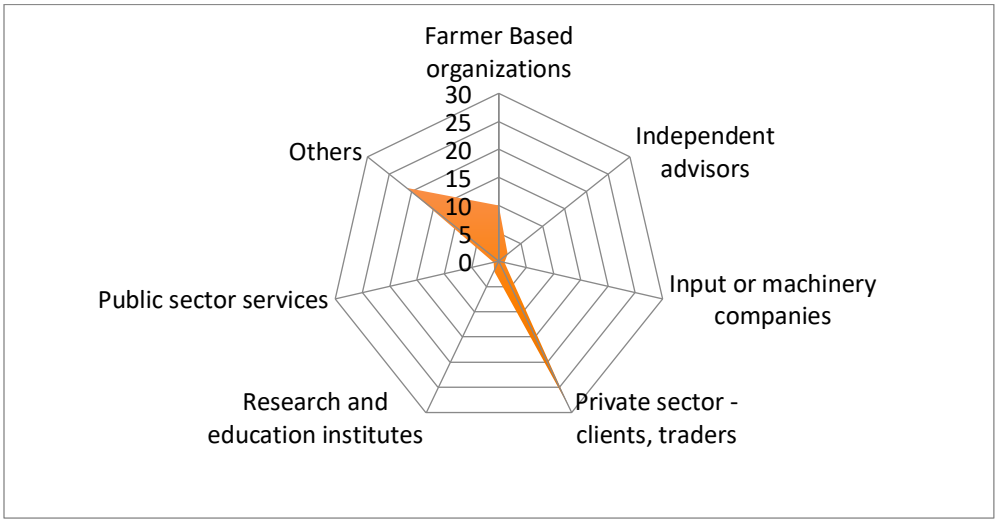
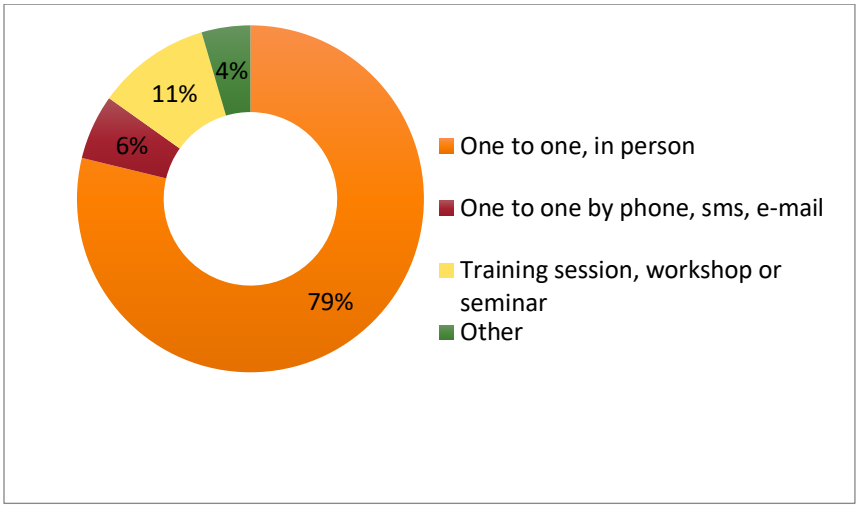


Figure 58: Advisory methods (stevia)



The most widely used advisory/communication method is individual, in person contact, including discussions that can take place everywhere, including coffee shops (Figure 59). This indicates the significance of interpersonal contacts in the advisory/innovation process; this is in line with the fact that discussions with others, is the farmers' most important source of knowledge.

Farmers' needs concern technical, marketing and certification issues as well as subsidies (Figure 60). At best, farmers are moderately satisfied by the quality of advice they get, especially from suppliers, and usually they cross check advice and input prices, since they are aware that suppliers' first concern is to increase sales rather than to provide them with best-fit solutions.

Figure 59: Important sources of knowledge (stevia)

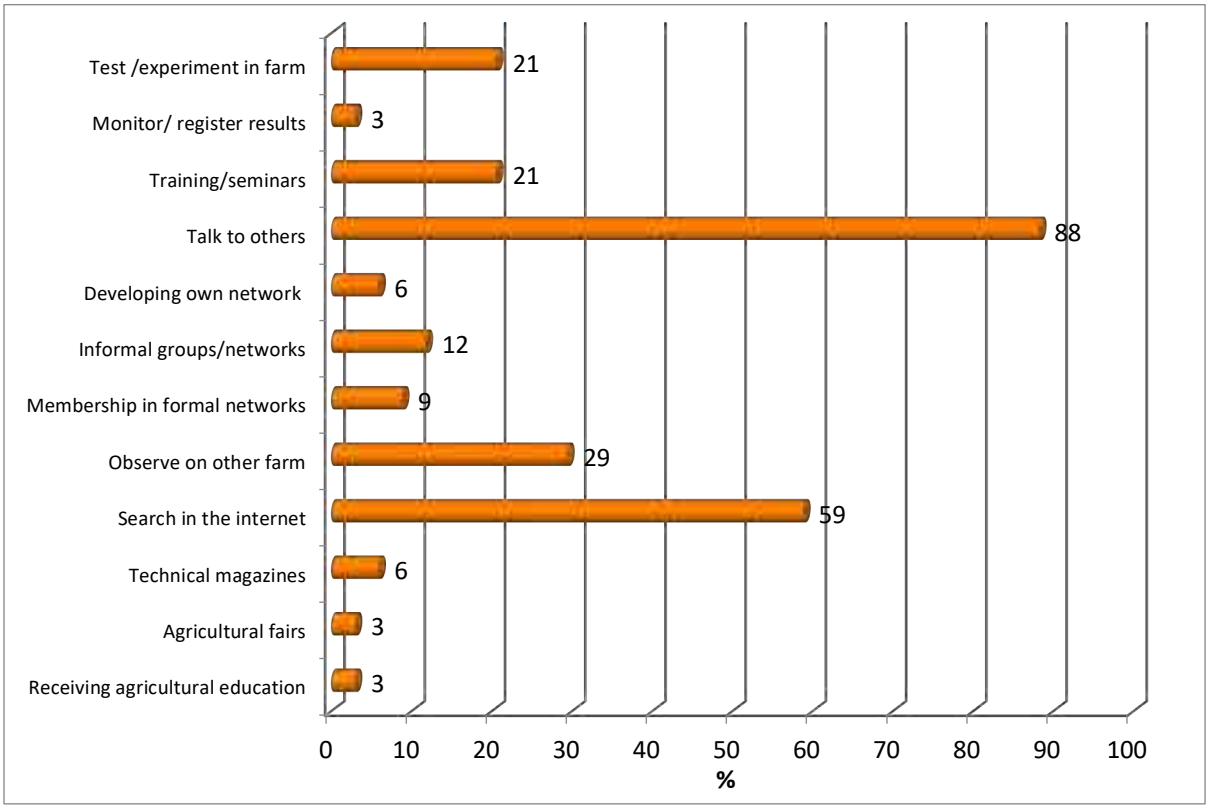
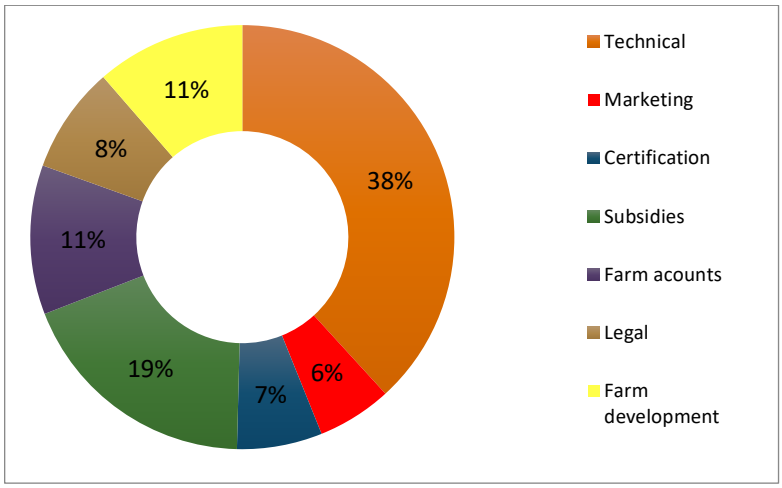


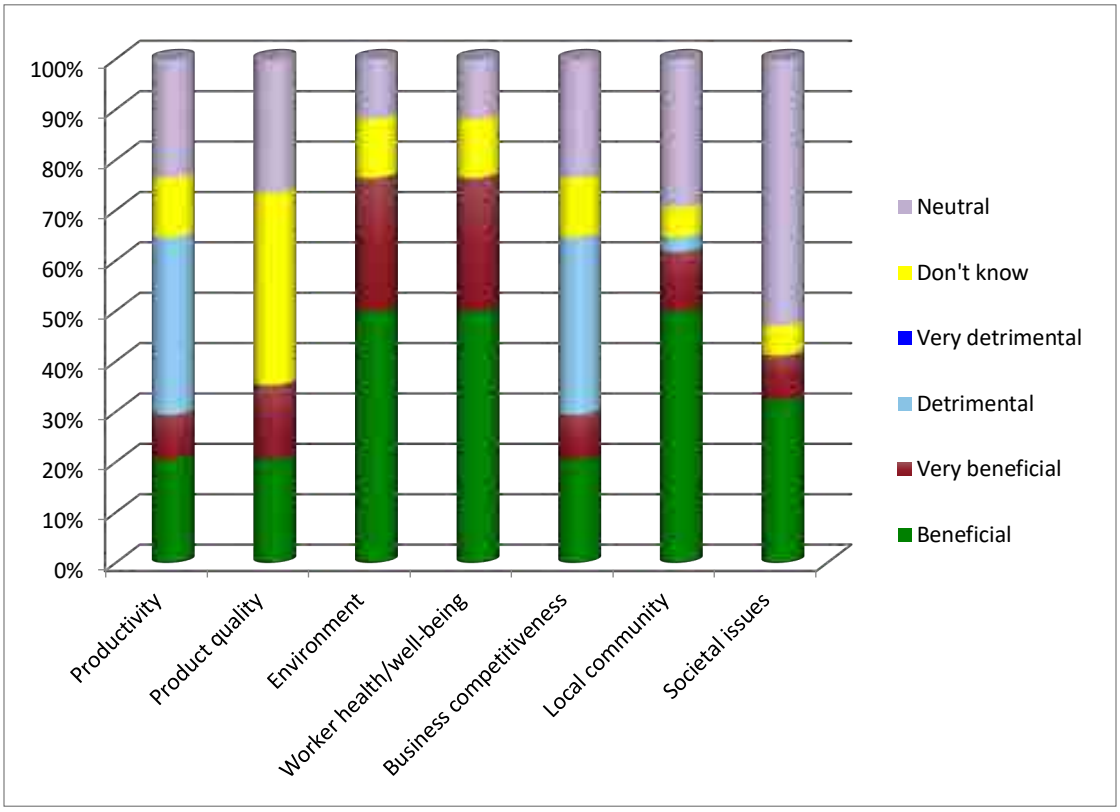
Figure 60: Farmers' needs for advice (stevia)



5.3.1.3 Farmers' innovation paths and trigger cycle change model

The sample of farmers consists of 16 adopters (including 2 droppers) and 18 non-adopters. The main reason for adoption as identified by both adopters and non-adopters concerns the prospect of profits related to the potential operation of the processing unit. On the other hand, there are several reasons for non- adoption: financial constrains were an important factor for many farmers since their involvement entailed also their engagement/registration in the stevia cooperative and the financing of the establishment of the processing unit; uncertainty as regards the efficiency of the experimental processing method to produce final product of the expected quality in combination with the lack of an alternative marketing plan; lack of advice on cultivation issues; worries of loss of income. Farmers' evaluation of the effect of the innovation on farm productivity and competitiveness, the environment, human well-being and the local society is based on both their expectations and their perception of reality.

Figure 61: Evaluation of the crop (stevia)



The awareness of the cultivation of stevia among Karditsa farmers was mainly the result of seminar held in 2012 (Figure 62). The contribution of researchers in raising awareness is shown in the Figure 62 to Figure 64 and concerns the abovementioned seminar. In the following years awareness activities were undertaken by the ASYST farmers themselves on the basis of one to one in person interaction or through workshops and groups discussions they organized. The category "other" includes family members and actors acting independently.

Figure 62: Initiation of awareness (stevia)

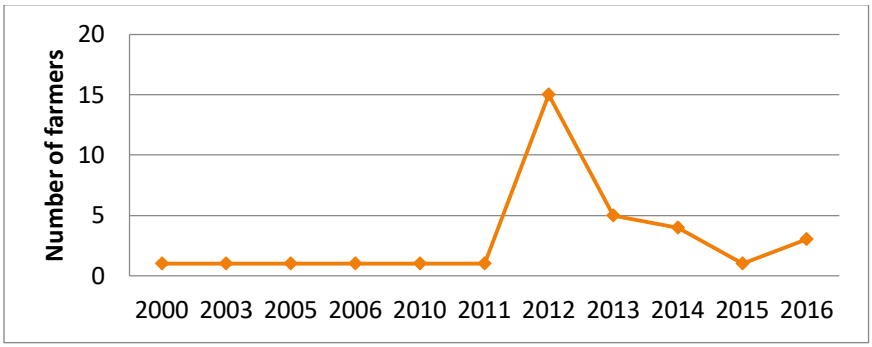


Figure 63: Communication methods – awareness (stevia)

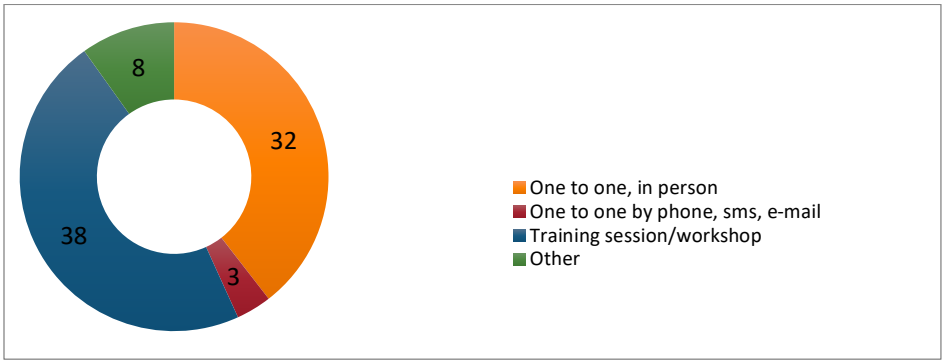


Figure 64: Actors – awareness (stevia)

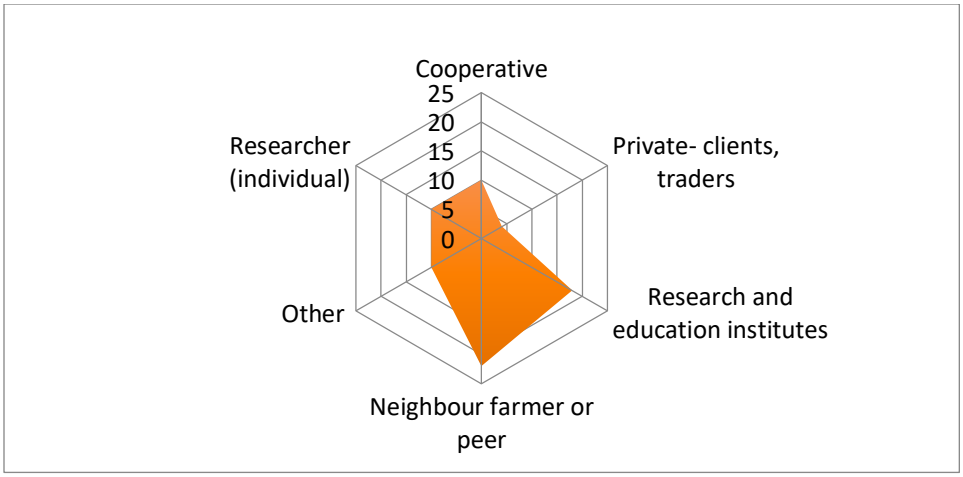
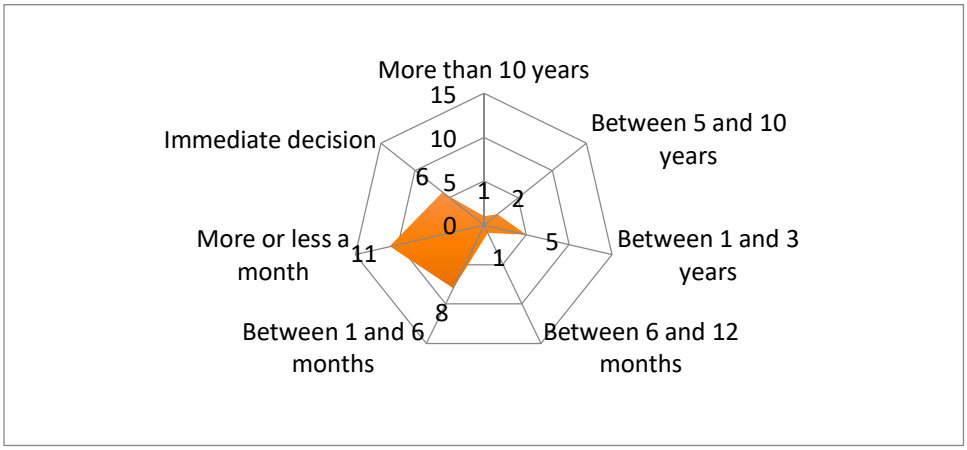


Figure 65: Time lag between awareness and active assessment (stevia)



Half of the interviewed farmers were engaged in the assessment of the cultivation of stevia within a period of a less than one month after awareness. During the assessment process peer-farmers continued playing an important role followed by researchers - during the pilots and workshops as well as seminars in the University of Thessaly (Figure 66); according to the farmers the most valuable information was drawn through discussions and the Internet. Farmers' membership in formal networks (Figure 68) refers to the stevia cooperative (ASYST).

Figure 66: Actors – assessment (stevia)

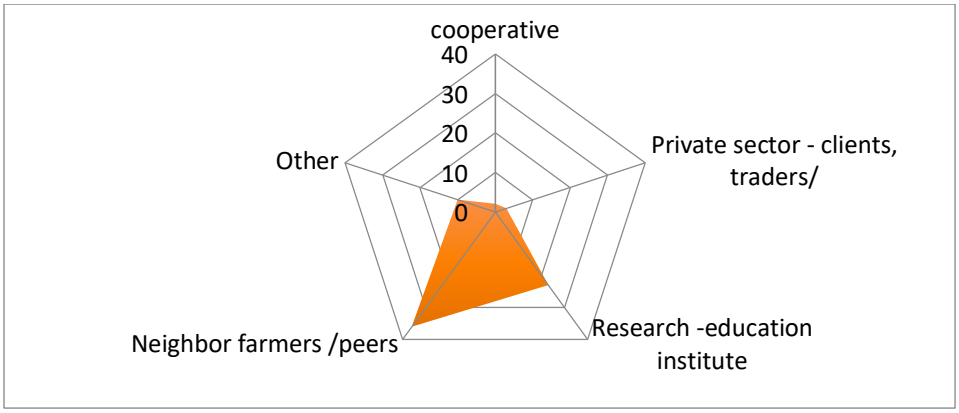
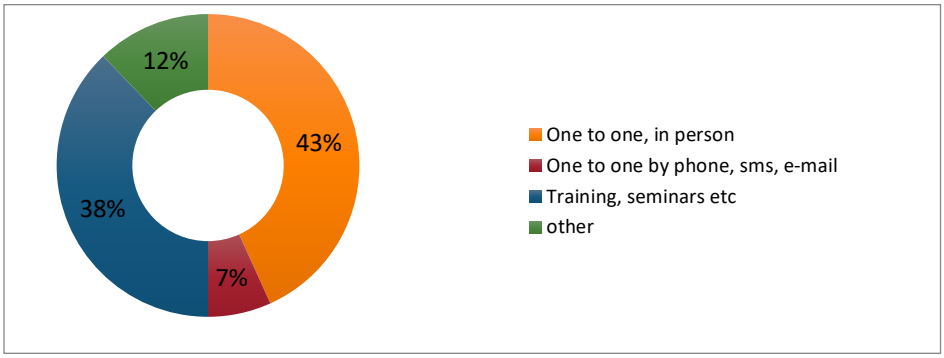
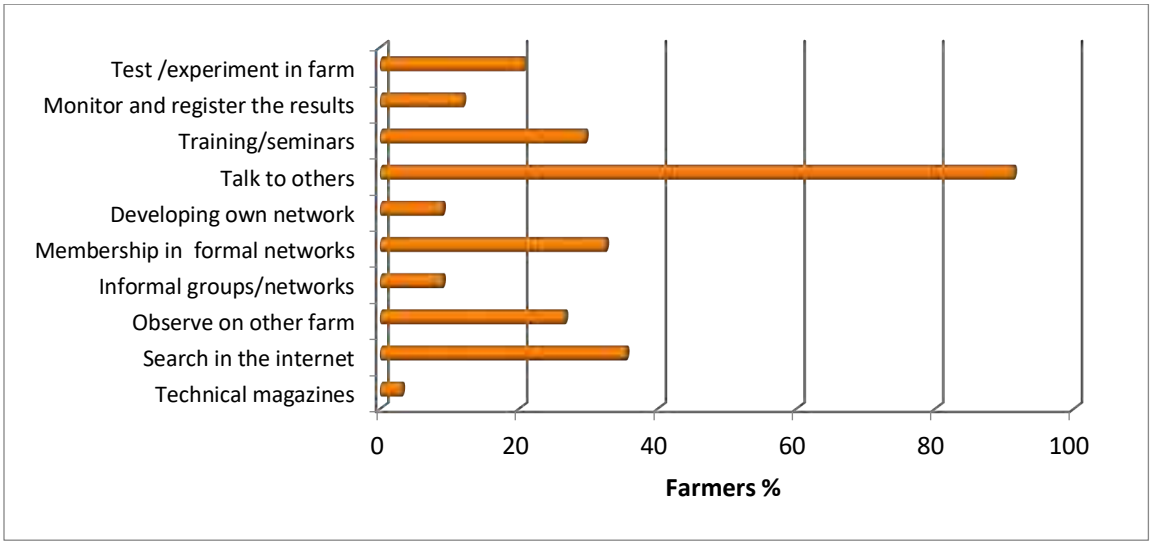


Figure 67: Advisory methods, assessment (stevia)



The arguments that the farmers took into account to get involved in assessment activities concern the potential benefits and expectations for increased income, thought they admitted that these benefits are not obvious and should not be taken for granted. Their uncertainties and the risks they undertook concerned the operation of the processing unit and the lack of alternative plan for placing stevia in the markets (56%) and the risk of losing income (23%) owing to the lack of know-how (cultivation practices) and the need for funding expensive investments relating to the drying of plant material before it enters the processing unit.

Figure 68: Important sources of knowledge, assessment (stevia)



Despite such worries some farmers started cultivating stevia, most of them motivated by the expectation of securing (increased) incomes, and others in order to get involved in a collective undertaking, meet new challenges and generate benefits for the local community as well. During the implementation process the members of the cooperative collaborated closely, organizing discussions, paying farm visits and exchanging valuable knowledge. Knowledge was acquired by the members who had run pilot fields and, at the time, had sporadic communication with the academic researcher and the researcher previously employed in the Tobacco Research Centre. Some members attended seminars delivered by the academic researcher in the University of Thessaly.

Figure 69: Farmers' activities, implementation (stevia)

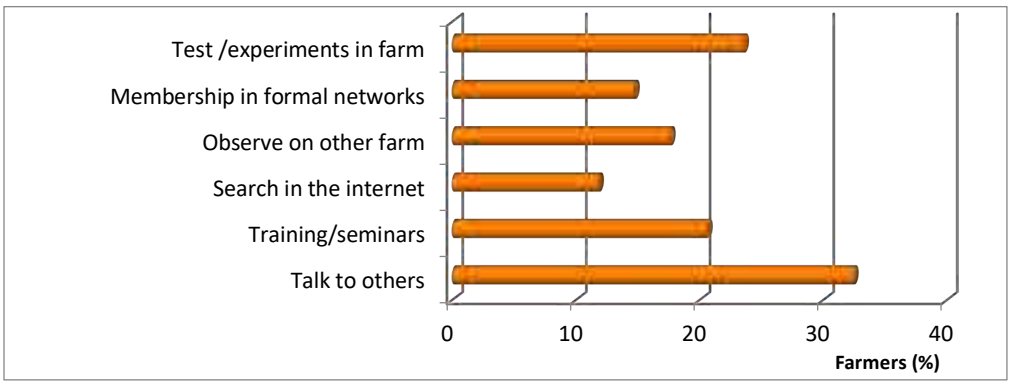
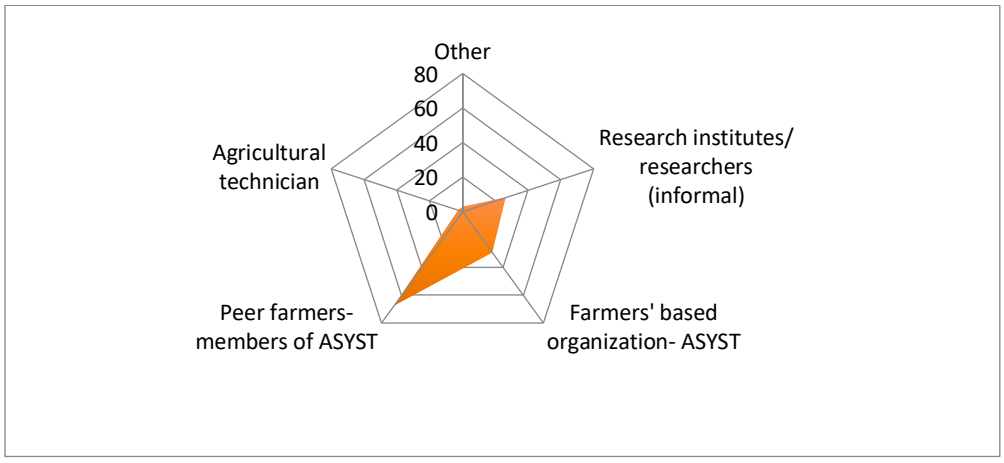


Figure 70: Actors, implementation (stevia)



Though ASYST managed to build an environment conducive to interaction and learning, at least two of its members decided to abandon the cultivation since the cooperative stopped collecting stevia leaves, after failing to get the processing unit into operation, and the lack of an alternative plan of placing the produce in the market. This reason also is referred to by half of the non-adopters as the main reason of their decision; other reasons concern the lack of know-how and support on cultivation issues, uncertainty as the innovation is at an experimental stage and financial restrictions given the high investment cost of the processing unit. Nevertheless, droppers intend to be involved again in the cultivation of stevia, in case the problem with the processing unit is solved.

5.3.1.4 Farmers' innovation micro-AKIS

In the case of stevia, farmers' awareness initially derived from dissemination activities organized by public (research and education) institutes; such activities were known to some of the Fanariotes group who took the initiative to invite researchers to the seminar held in 2012. These activities stimulated the interest of farmers who had already been in a process of thinking about changes at their farms and/or recognized in stevia an opportunity to secure or increase their income. Some farmers sought also information about

stevia from the input suppliers they collaborate with but none of them could advise them since stevia was a totally new crop in Greece. Accordingly, the innovation micro-AKIS is differentiated considerably from their "general" micro-AKIS.

In the process of assessing the innovation farmers again based their decision on information and knowledge they acquired from the researches and discussions they made mostly with other farmers -members of the cooperative but also within their families and friends.

During the implementation the farmers supported each other, disseminating knowledge and experience they got in the previous stage during running the pilots fields.

5.3.2 Findings from the AKIS experts interviews and advisory organisations survey

5.3.2.1 Advisory landscape in the focus region

The advisory landscape in the focus region does not differ from the rest of the country, as it is shortly described in section 1. Therefore, in Karditsa farmers depend on private sector agronomists for technical advice to manage their crops and on private sector consultants for advice on issues mainly concerning subsidies, and access to EU programs/measures and farm development issues. Additionally, at local level the Development Agency of Karditsa plays an important role since it informs and supports the (innovative) initiatives of individuals and collectivities, focusing on farmers. It provides technical support on groups' initiation/establishment, networking with knowledge centres and training activities.

5.3.2.2 Key players of advice for the innovation area in the focus region

The key players in the case of stevia were mainly two research institutes and their respective researchers as well as the stevia cooperative (ASYST) and its members. However, the advisory landscape also includes actors who played a secondary but vital role.

At the outset, in the period 2000-2004, the Tobacco Research Centre and the University of Thessaly carried out experiments to test stevia as an alternative to tobacco and the research outcomes were published. In 2012 an informal group originating from the local community of Fanari (a small town in the Karditsa area) took the initiative to organize seminar about stevia for the local community. This group was active in organizing similar events, i.e. calling experts to provide information on topics of interest to local farmers. Therefore, it played a not so apparent but important role in farmers' awareness about the cultivation of stevia.

The two researchers invited in the seminar, not only raised farmers' awareness but presented such evidence that set out farmers' assessment process. Therefore, assessment was triggered during the seminar and continued during the subsequent cultivation period, when the farmers run pilot fields under the guidance of the academic researcher; members of ASYST attended seminars delivered in the University of Thessaly, while the academic visited some farms and suggested cultivation practices to farmers. Then the farmers disseminated the knowledge they gained to their colleagues organizing discussions and visits to the pilot farms.

In the initial stage of innovation the Development Agency of Karditsa played an important advisory role as well; its consultation concerned mainly the establishment of the stevia cooperative (ASYST) - it was not

involved in any way with the cultivation of stevia as such. In parallel, the members of ASYST run their own information campaign, organizing discussions/ in neighbouring areas to attract new members and strengthen their cooperative; thus they raised awareness among their colleagues. Additionally the Board and some members of ASYST came in contact with "Anthir" a company engaged in the production and trading of aromatic and medicinal plants and stevia in another region; The farmers also asked the input suppliers they usually collaborate about stevia but their knowledge was very poor. The subsequent cultivation period ASYST started the implementation stage; during this period it continues organizing interaction activities among its members, i.e. regular meetings and discussions.

However, some AKIS actors (including non adopters) criticized the choice of ASYST not to seek continuous support from a reliable and knowledgeable scientific partner, claiming that they (ASYST) underestimated the need for scientific knowledge. As far as the farmers' motivation is concerned, the actors claim that the potentially increased profits and the urgent need of cotton producers to replace it with a farmer and environment - friendly cultivation led them to adopt stevia.

With reference to public policies, all AKIS-actors pointed to farmers' need for systematic, appropriate and reliable information, advice and training. Some actors also claimed that, given the ineffectiveness of the public sector, the private sector should play a more active role in the provision of advice to farmers; moreover, farmers should be able to distinguish the cost of advice from the cost of the inputs and evaluate the quality of advice, which, in turn, should be provided by knowledgeable agronomists.

Furthermore, actors commented that novelties start as good ideas but often they are only partially implemented without any tangible impact. Farmers often need to be motivated to adopt changes; if implementation is not an easy process and there is no profound benefit, they easily bypass advisors/advice.

5.3.2.3 Transformation of advisory landscape

In the case of stevia the key actors were researchers – already pensioners in 2012 - acting mostly on their own initiative and farmers-members of the stevia cooperative. The Board of the cooperative encouraged knowledge exchanges among its members but it did not invest in the enhancement of their knowledge base through the interaction with knowledge centres. The rest of the local AKIS actors involved with stevia played only a marginal role and did not affect the advisory landscape of the innovation. The innovation is important for 3 out of the 5 interviewed advice suppliers; they claim that 3 of their advisors were involved in the innovation but in combination with other tasks and attended the seminars in the University of Thessaly.

6 Discussion: Answering research questions

6.1 Role of advisory suppliers in the farmers' TCM and innovation paths

The role of advice suppliers varies among the cases throughout the stages of the innovation processes, depending on the specific regional context, the orientation and administrative characteristics of the involved organizations and the specialization and advisory ability/capacity of the involved individual actors. The case of mating disruption (MD) in Imathia corresponds to the classical extension paradigm in which advisors create awareness of farmers for a technical innovation, bridging the gap between researchers and farmers. In contrast, the cases of avocado and stevia crops are, at the outset, research driven innovations; both initiated by researchers, who approached farmers aiming at the dissemination of their research outcomes.

In Imathia the involved advisors made use of several methods to stimulated farmers' interest: they adopted one to one in person contact in order to approach a number of medium / big farm-holders, who disproportionately affect the effectiveness of the innovation at farm level, because of their farm size; also they used group methods, by organizing seminars and workshops in collaboration with the cooperatives in order to attract the interest as many peach growers as possible. The researchers engaged in stevia and avocado also adopted one to one and group communication methods to raise awareness among farmers. Moreover, as far as the case of stevia is concerned the farmers themselves created awareness among their colleagues at a latter stage, organizing group meetings and by one to one in person contact.

Despite the fact that in general all three innovations are market driven, this element is clearer during raising awareness process in Imathia and Karditsa. In both cases, and especially in MD, during awareness the involved farmers were already conscious of the need to reduce inputs and pesticides, improve their farm competiveness and cooperatives access in the market and, thus, achieve financial sustainability at farm level. Therefore, an evaluation of the situation had already be done in a way and the need for change had been recognized by a number of the adopters, before becoming aware of the innovation; the awareness activities initiated by the independent advisors and researchers represented opportunities for these farmers of giving direction and concretize their already perceived need for change. This, however, is not the case in the cultivation of avocado, where awareness activities were not connected with an immediate need for systemic change imposed by external factors (the market). Instead, the vast majority of farmers continued cultivating traditional crops for years after the first awareness activities took place and only when the situation in the market changed dramatically, they were engaged in an assessment process of the crop.

Furthermore, all three cases have an environmental sustainability aspect, although to different degrees. In MD, this aspect is stronger since many adopters appeared motivated to protect the environment and human health. In the case of avocado this angle emerges through the need of protecting natural resources (water) in scarcity; similarly, in the case of stevia the need for prudent use of inputs is mentioned but mostly within the framework of achieving financial sustainability, which prevailed. In any case the realization of innovation systems leading to improved sustainability is linked not only to the adoption of the innovations but also with the general ability of systemic actors to support such systems.

The assessment stage presupposes the availability of a wide range of information concerning technical and financial issues including the potential impact of the innovations to the environment as well farms'

performance/viability. In the case of MD the involved advice suppliers acquired the necessary knowledge to support farmers during all innovation stages mainly from other consultancy enterprises and input industries. In the cases of avocado and stevia farmers sought guidance mainly from researchers and research institutes. However, due to the lack of the necessary, intense collaboration with them, eventually the role of peer farmers was strengthened during the innovation process and farmers' knowledge relies to a significant degree on discussions with other actors, observations on other farms and peer-to-peer exchanges.

Exchanges among peer-farmers are integrated in their everyday life and in many cases cannot be separated from their social life. When there is an issue of concern, discussions can include two three or more participants and can take place everywhere: at farms, at input supply shops, at coffee shops, even on the way going to or returning from the farm. However, the knowledge gained from these exchanges is not always valid and many farmers are aware of it, pointing out that perception and critical thinking are among the skills needed for successful farming.

During the implementation stage advice suppliers (including peers) were in general focused on the technical part of the innovation, employing personal contacts at farm and outside the farm, seminars and workshops, farmers' discussion groups (the stevia cooperative) and publications (research institutes). Advice suppliers pointed out the need for valid and easily accessible knowledge for both farmers and themselves, mentioning the need for certain tools- such as digital knowledge platforms, soil maps etc. that could support them in their task throughout all the innovation stages.

6.2 Farmers diversity and role of advisory in innovation uptake processes

In general, farmers' ability to adopt innovations and the relationships among the different types of farmers and advisors are related to the specificities of the selected innovations, farmers' perceptions and financial standing as well as regional specificities. The latter derived mainly from the fact that the landscape of AKIS actors involved in the innovation appears to be more coherent and structured in Imathia than the respective regional context in Chania and Karditsa. The connection between adoption and farmers' financial standing is evident in farmers' interviews for the cases of MD and stevia.

In Imathia the basic differentiation among adopters and non-adopters is largely related to the perceived effectiveness of the innovation and the interpretation of human intervention in the natural balance. The fact that only the extensive implementation of the method can generate significant benefits for farmers, lead some of them to reject the method, especially if the neighbouring farms are abandoned or the owners do not intend to adopt the innovation. Moreover, some non-adopters claim that MD further distorts the ecological balance of peach orchards; however peach orchards, as an intensive single crop farming system itself, constitutes a distorting intervention in the ecological balance as such. Nevertheless, it seems that different perceptions do not affect the level of interaction between non-adopters and the advisors supporting the adoption of the MD and trusted relationships, whenever they exist, remain unchanged.

In the case of MD, further differentiation can be traced among adopters supported from independent advisors in the framework of their official collaboration with the cooperatives and adopters who were supported by input supply stores and mainly are not members of cooperatives. In Imathia the existence of strong cooperatives has been the critical factor of the whole innovation process at all stages. The link between the independent advisors and cooperatives is also strong and their interaction characterized and

changed the whole advisory landscape at local level. Moreover, the critical role of independent advisors in the whole process of the Integrated Pest Management Control in Imathia and the need for more advisory staff, created conducive conditions for the active involvement of the local - input providers into the innovation process.

The situation, however, is different in Chania and Karditsa. In Chania the normal categorization among adopters and non-adopters is pointless, because of the widespread dissemination of the cultivation of avocado. However, in a way adopters can be classified in relation to the advisors they are more closely connected with. For example, organic avocado growers are all linked to /supported by the Organic Growers Cooperative; additionally, a number of growers usually consult the local Directorate of Agricultural Economy and Veterinary. There are farmers, successors of the first adopters, who continue consulting the pensioner academic who started his carrier as a researcher in the Institute of Olive Tree and Subtropical Plants and Viticulture in 1970s. Certainty, there are avocado growers connected with many or most of the available advice suppliers, while many others are not connected with any of them and rely more or exclusively on peer to peer interactions. Common perceptions on farming, personal preferences, friendships, family bonds and traditions seem that play a role in the relationships among farmers and advisors in Chania.

On the other hand, in Karditsa, the stevia growers were engaged in experiential /learning by doing processes and shared such knowledge, forging strong ties with each other. The fact that, apart from the two researchers who helped in the initiation of the innovation, there was no other knowledgeable advice supplier able to help them with the cultivation of stevia, certainty guided them to this direction. This also deprived the stevia cooperative from basing their knowledge on stable/scientific foundations and also from connections and synergies with potential business partners and other AKIS actors involved in the cultivation of stevia.

6.3 Transformation of advisory suppliers and farmers' innovation uptake processes

In Imathia the transformation of the advisory landscape was the result of the cooperation between the leading cooperative and the independent advisory company, which gradually became an example to follow for other cooperatives and independent advisory companies. This eventually opens information channels for farmers and helps in improving their access to appropriate, fair and reliable advice. Moreover, independent advisors played an important role in connecting the local cooperatives and oriented them to common actions in relation with the innovation, supporting them with technical backstopping and advocacy services to influence key actors and policy makers for change (e.g. inclusion in the agri-environmental measures).

In Chania the advisory landscape is more fragmented; various actors try to support avocado growers and enhance relevant knowledge albeit with dubious results. The main collective activity of the key advice suppliers is their engagement in an informal working group aiming at promoting proposals, which the regional government is called to accept and realize. However, this activity has not yet produced significant results for avocado growers and one reason for this is that it is not officially supported.

In Karditsa the stevia cooperative and its membership were engaged in experiential activities that enhance their knowledge and abilities not only in relation to the cultivation of stevia but to other crops as well. Though the farmers are engaged in participatory learning, the fact that it concerns an internal activity of

the cooperative does not create space for developing interactions and synergies with other actors. Therefore, no changes in the regional advisory landscape have been produced.

Advice suppliers in all cases recognize farmers as valuable sources of knowledge; this indicates that knowledge co-creation really occurs, at least to a certain degree. Additionally, the key advice suppliers in Imathia and Chania are engaged in multi-actor networks (including researchers, policy makers, traders, input industries) and developed knowledge brokerage and intermediary activities. This also applies in the case of stevia provided that all aspects of the innovation (including not only the new cultivation but also the establishment of the processing unit) are taken into account (see AgriSpin Project).

7 Case study narratives

This section was removed due to GDPR regulations.

8 Conclusions: Insights & Highlights

INSIGHTS

The role of advice suppliers varies among the cases throughout the stages of the innovation processes, depending on the specific regional context, the orientation and administrative characteristics of the involved organizations and the specialization and advisory capacity of the involved actors. The case of mating disruption in Imathia corresponds to the classical extension paradigm in which advisors create awareness of farmers for a technical innovation, bridging the gap between researchers and farmers. In contrast, the cases of avocado and stevia crops are, at the outset, research driven innovations.

In general, farmers' ability to adopt innovations and the relationships among the different types of farmers and advisors are related to the specificities of the selected innovations, farmers' perceptions and financial standing as well as regional specificities. The latter mainly owes to the fact that the landscape of the AKIS actors involved in the innovations examined here appears to be more coherent and structured in Imathia than in Chania and Karditsa.

In Imathia the transformation of the advisory landscape was the result of the collaboration between cooperatives and independent advice providers. In Chania the advisory landscape is muddled; various actors have been trying to support avocado growers and enhance knowledge with dubious results. Avocado growers rely at large on peer-to-peer exchanges throughout the innovation process. The main collective activity of the key advice suppliers is their engagement in an informal working group aiming at promoting proposals, which the regional government is called to endorse. However, this collective activity has not yet produced significant results for avocado growers partly owing to its non-formal status.

In Karditsa, the stevia cooperative was involved in experimental/experiential activities that enhance its members' knowledge and ability to interact not only in relation to the cultivation of stevia but with reference to other crops as well. Nevertheless, the fact that this concerns an internal activity of the stevia cooperative it does not create space for developing interactions and synergies with other actors and consequently it does not generate changes in the regional advisory landscape.

Advice suppliers in all cases identify farmers as valuable sources of knowledge; this indicates the possibilities for co-creation of knowledge. Throughout the diffusion of innovations, the key advice suppliers in Imathia and Chania have been engaged in multi-actor networks (including researchers, policy makers, input industries and traders) and developed intermediary activities.

Experiential, peer-to-peer learning took place among the farmers involved in the cultivations of avocado and -especially- in stevia, which supports the potential for future success through sharing of knowledge and sustained collaboration. In the case of avocado farmers' interaction and the exchange of knowledge and experiences were essentially contributing factors for growers making an income. Peer-to-peer learning took place among the advisors involved in the case of avocado as well. At the same time the dissemination of non- checked information and opinion exchange without the possibility of scientific verification drove in many cases avocado producers to successive failures. This evidence highlights the potential benefits of peer -to- peer learning but also the urgent need for structured advisory services and better linking research with practical farming.

HIGHLIGHTS

Good stories

In the case of MD in Imathia, the established collaboration between the leading independent advisory company and the local cooperatives created conducive for the adoption of innovations conditions and became an example to follow for other cooperatives and independent companies.

Failure stories

In the case of stevia the failure concerns the weakness of the stevia cooperative to develop a stable network of experts and market partners (e.g. seed suppliers and nurseries). Thus, the farmers involved were deprived from essential knowledge and guidance on cultivation issues that, in turn, limited their access to resources and their dynamic for rapid expansion.

Gaps

In the new crops' cases, the gap concerns the lack of concrete information on the innovations, especially as far as the demands in terms of relevant investments are concerned, which in turn made the related to the adoption risks vague for farmers.

In the case of avocado, the lack of strategy and institutional support to key-advisors, who are voluntarily engaged in activities supporting avocado growers, undermines any individual initiatives for collective action and the developmental potential of individual efforts. Moreover, the lack of necessary data and tools for advisors undermines their ability to help farmers to assess and implement the innovation.

Surprises: The ability of individual actors to be connected with each other by mobilizing their social networks and draw vital information and support from them is evident in the three cases. Especially in the case of stevia, dynamic, informal networks created an opportunity for local development, while farmers' ability for self-organization and collegiality generated unexpected benefits for those involved.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727571